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ABSTRACT

Four conference papers on discourse are included. In "How Context Contributes to the Interpretation of Temporal Expressions," Carlota S. Smith provides a summary analysis of the temporal interpretation of English sentences. Many sentences are shown to be semantically incomplete; it is argued that information from neighboring sentences is used to compelete their interpretation. "Discourse Structure from an Artificial Intelligence Point of View" by Steven Rosenberg presents an overview of a theory of discourse structure that relies on a set of cues to provide links between sentences of the discourse. The frequency with which these cues are found in newspaper articles is examined. In answering the question, "Can Rules Be Devised to Make Implicit Inter-sentence Case Relationships Explicit?" Patrick J. Finn proposes models in which language cognition is in part a process of assigning values to variables that correspond to universal, innate concepts that identify certain types of judgments. It is hypothesized that inferences arise from commonality of features of given and missing case values. Finally, in "Discourse Processes in Elementary School Children," William J. Russell and David Snow report on a study of the development of pronominalization in the speech of native English and Spanish speaking elementary school children. (JB)

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TOPICS IN DISCOURSE: REPORT OF THE SECOND ANNUAL MEETING OF THE DISCOURSE LINGUISTICS SPECIAL INTEREST GROUP OF THE AMERICAN EDUCATIONAL RESEARCH ASSOCIATION, APRIL 4-8, 1977

William J. Russell, Editor

ABSTRACT

The second annual symposium of the Discourse Group was held in connection with the annual meeting of the American Educational Research Association in New York on April 8, 1977. A follow-up symposium by mail completed the interchange, and the result is contained in this report.

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TOPICS IN DISCOURSE: REPORT OF THE SECOND ANNUAL MEETING OF THE DISCOURSE LINGUISTICS SPECIAL INTEREST GROUP OF THE AMERICAN EDUCATIONAL RESEARCH ASSOCIATION, APRIL 4-8, 1977*

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HOW CONTEXT CONTRIBUTES TO THE INTERPRETATION OF TEMPORAL EXPRESSIONS

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This paper is concerned with the temporal interpretation of English sentences. I begin with a discussion of temporal interpretation, and a summary analysis of how sentences are interpreted. I will show that many sentences are incomplete semantically, although they are syntactically well-formed. The second part of the paper is devoted to a discussion of how such sentences are interpreted; I argue that information from neighboring sentences is used to complete their interpretation. Finally, I will comment on the significance of the approach taken here.

1. TEMPORAL INTERPRETATION

My analysis is based on the scheme of temporal specification developed by Hans Reichenbach. The analysis shows how Reichenbach's scheme is realized in English; it takes the form of a set of principles that relate surface sentences to temporal semantic interpretations. I will summarize the analysis here.[1]

Three notions of time are involved in temporal specification: Speech Time, Reference Time, and Event Time. Speech Time (ST) is the time at which a given sentence is uttered, that is, the moment of utterance. Reference Time (RT) is the time indicated by a sentence, which need not be the same as ST. Event Time (ET) refers to the moment at which the relevant event or state occurs, which need not be the same as RT. For instance in (1) ET and RT are the same, and are prior to ST:

(1) Old Mrs. Starkadder saw something nasty in the woodshed before 1929[2] (see editor's note at the bottom of this page).

In (2) all three times are different:

(2) Jeb had already fallen down the well last week.

In this sentence ST is the moment of utterance, RT is last week, and ET is an unspecified time prior to last week.

To understand the temporal specification of a sentence, one must know the values of the three times, and their relations to each other. The times may be simultaneous, or one may follow the other. ST is the keystone of the system, in that RT is oriented to it. The orientation of RT to ST means that when RT is simultaneous with ST, RT indicates Present time;[3] when RT precedes ST it indicates a time in the Past; when RT follows ST, a Future time is indicated.

Editor's note: In the version seen by Chaudron and McCoard, example (1) appeared as above. Subsequently, the author corrected a misprint. It should read, " --- in 1929[2]."

Considering how these three times might be signaled in English, one notices a serious disparity between syntax and semantics. Tense is the only temporal element that is obligatory in a grammatical sentence, yet the semantics of temporal interpretation requires three different times. To resolve the problem of this disparity, I will take as basic those sentences that allow complete semantic interpretation, whether the temporal elements that occur in them are obligatory or optional from the syntactic point of view. Such sentences have both tense and a time adverbial, as I will show directly; therefore, sentences with tense only are incomplete semantically.

What is needed for temporal interpretation is specification of RT, and of the relation between ET and RT. ST need not be explicitly given on the surface--although it is crucial to the system--because it can be inferred automatically if one knows RT. Sentences that can be interpreted in this way have a time adverbial as well as tense: it is the combination of tense and adverbial that specifies RT. To see this, compare (1) above with a counterpart sentence having only tense:

(2) Old Mrs. Starkadder saw something nasty in the woodshed.

In (1) we are given a specific RT--1929 in the Past--and also the information that ET preceded RT-cf. before. In (2), however, RT is not specified and we do not know the relation between ET and RT.

The interpretation of (1) follows a pattern that is general for English: tense and time adverb establish RT, and the preposition introducing the adverb gives the relation between ET and RT. The role of the adverb is even clearer in the next examples, which have the same tense but establish different RT.

(4) Reuben is lurking in the woodshed right now.
(5) Adam is driving the buggy to Howling on Tuesday.

The time adverbial in (4) indicates Present, that of (5) indicates Future. The classification of adverbs according to the value they indicate is essential to this analysis, and is summarized below.

The temporal expressions in English have consistent relational values, although they differ, of course, in absolute value. The relational values are Simultaneous, Anterior, and Posterior, the only relations that obtain between times. The relational values of temporal expressions are essential to the interpretation of simple and complex sentences; this is reflected in the principles of interpretation presented in Smith, 1976c, and in the discussion below.

(6) Relational values of temporal expressions in English

Anterior	Simultaneous	Posterior
past tense	present tense	
Past adverbs: *yesterday*, etc.	Present adverbs: *now*, etc.	Future adverbs: *tomorrow*, etc.
Unanchored adverbs: *Tuesday*, *March*, etc.		Unanchored adverbs: *Tuesday*, *March*, etc.
auxiliary *have*[4]		
Past prepositions: *before*, etc.	Present prepositions: *on*, *in*, Ø, etc.	Future prepositions: *after*, etc.
Past RT	Present RT	Future RT

Of the possible combinations of tense and adverbial,[5] five establish RT, as indicated in (7).

(7)

	tense	adverb	RT	
a.	present	Present	Present	Cousin Judith is sleeping now.
b.	present	Future	Future	Mrs. Nettle is coming tomorrow.[6]
c.	past	Past	Past	Seth worked in the garden last week.
d.	past	Unanch.	Past	Seth worked in the garden on Tuesday.
e.	present	Unanch.	Future	Mrs. Nettle is coming on Tuesday.

Note that Unanchored adverbs contribute to Past or Future RT, depending on the tense with which they occur. All of these sentences are complete semantically: They establish RT and give the relation between ET and RT.[7] Note that the relational values for tense and adverbial are compatible.

There are combinations of tense and adverbial, however, that do not establish RT, as the examples below indicate. None of these sentences can be interpreted without further information: what is needed is a point of orientation, that is, RT. These examples show that it is not sufficient for a sentence to have tense and a time adverbial: for a complete temporal interpretation, the two must form a combination that establishes RT. The combinations that do not establish RT have incompatible relational values.

(8)

	tense	adverb	
a.	past	Future	Elfine was leaving in three days.
b.	past have	Unanch.	Flora had read the letter a week ago.[8]
c.	past	Present	Aunt Ada Doom was annoyed now.
d.	present	Past	Last night, Jeb lets the bull out.

Sentences like 8a-c occur either as complement sentences dependent on other sentences, or as sentences that are syntactically complete, but dependent semantically on other sentences. Their interpretation is discussed in section 2. 8d exemplifies the Historical Present, which will not figure in this discussion; it appears to be dependent on context in ways not yet understood.

Another feature of temporal interpretation must be mentioned before incomplete sentences can be approached directly. The examples above have referred to specific events, but there are many sentences that do not so refer. These are habitual sentences, which have characteristically a frequency adverb that indicates recurrence of an event or state. In terms of Reichenbach's scheme, the frequency adverb specifies ET.[9] For instance:

(9) Jeb Starkadder sometimes throws crockery.
(10) Reuben lets the cows out every morning at 7 a.m.

Time adverbials may occur as part of a frequency adverb, as in (10), their role in specific sentences is part of the specification of RT, on the other hand. Time adverbs thus function differently, depending on the configuration of temporal expressions in which they occur.

Finally, note that English sentences have only one time adverbial and one frequency adverbial, although both may be of unlimited complexity.

2. INCOMPLETE SENTENCES

According to the analysis given here, many sentences are incomplete temporally, since the only temporal expression required for grammaticality is tense. A sentence may lack a time adverbial, or may have a combination of tense and adverbial that does not specify RT. But if this is correct, and such sentences are incomplete temporally, one faces a dilemma: either one must abandon the analysis as incorrect, or explain the fact that people do interpret such sentences, consistently and without any indication of difficulty. The problem of their interpretation arises for two very different situations: sentences that occur in a context, and sentences in isolation. I discuss here the interpretation of sentences that occur in context. I will show that they are interpreted in a manner consistent with the analysis of section 1: material from neighboring sentences is taken as applying to the incomplete sentence as well, so that a complete temporal interpretation is obtained. Sentences that are interpreted with material from neighboring sentences are vague, not ambiguous. The problem of interpretation is not to decide between structures, but that too little information is given to assign a semantic structure at all.

a. Dependent combinations of tense and adverbial

Sentences with incompatible combinations of tense and adverbial can be interpreted only if an RT is specified. Since English allows only one time adverbial per sentence, it seems that the specification of RT must involve another sentence. And examination of sequences of sentences bears out this prediction: one sentence can specify RT for another sentence. Consider the following sequences:

(11) Seth told Flora about it last Tuesday. Jeb had fallen down the well three years ago.

(12) Mrs. Starkadder told them the plans Sunday afternoon. Elfine was leaving in three days.

(13) It was Sunday afternoon and they had been waiting for Adam and Reuben for several hours. Aunt Ada Doom was annoyed now.

The second sentence in each sequence is incomplete, and dependent on the preceding sentence for its interpretation. In (11) and (12), the first sentences give RT for ago and in-; in (13) the first sentence gives a value for now.

Incomplete sentences of this type occur fairly often in rather formal narratives, and in prose written in the style indirecte libre.[11] They also occur as complements, as in (14):

(14) Seth told Flora on Tuesday that Reuben had fallen down the well three years ago.

To account for the interpretation of complements such as that of (14), I have proposed that the complement sentence shares the time adverbial of the matrix, when matrix and complement have the same tense. In other words, the time adverbial of the matrix applies to the complement also. RT for the complement is established by the complement tense and the matrix adverbial.[12] Consider now the function of the complement adverbial. I pointed out in section 1 that time adverbials and tense establish RT, and that in independent sentences the relation between ET and RT is given, but ET is not actually specified. The situation is different for dependent sentences. (By dependent sentences I mean complements, or sentences that are incomplete semantically.) Since dependent sentences have RT established by the adverbial of another sentence, their adverbials are available, as it were, to specify ET. And this is the interpretation of the complement adverbial in (14): the event of the complement is taken to have occurred three years before Tuesday. This same account holds for incomplete sentences that are independent semantically: for them, too, the complement adverbial specifies ET. In English, then, ET can be specified only by a dependent sentence. It is striking that the rules needed to account for the temporal interpretation of complements apply also to sentences that are independent syntactically.

b. Tense only--Past

Sentences that have no temporal expression other than tense are vague. If the tense is past, they indicate roughly a reference period (but see (20) and (21) below) but do not specify RT; nor do they give the relation between ET and RT. If the tense is present, they indicate neither RT nor the relation between ET and RT. Such sentences occur frequently and are rarely taken as incomplete. The reason is that material from neighboring sentences is used to complete their interpretation; in particular, adverbials from sentences with the same tense are taken to apply to the incomplete sentences.

Consider, for instance, the interpretation of (15) if preceded by (16a), (16b), or (16c); each leads to a different interpretation.

(15) Jeb Starkadder was throwing crockery.
(16) Flora was awakened by a strange racket just (a) before dawn.
(b) at dawn.
(c) after dawn.

The conditions for sharing are minimally that both sentences have the same tense. For instance, the sequence (17) does not allow complete interpretation of (15):

(17) Aunt Ada Doom is coming downstairs at this moment. Jeb Starkadder was throwing crockery.

What is needed for interpretation is a sentence that has the same tense and a time adverbial. The sentences may be contiguous, as in the examples here; one may precede or follow the other; they may be separated; the missing information may be supplied by shared extralinguistic knowledge. The conditions under which sentences may share material from other sentences is an interesting and important topic for research.

I have shown how a sentence with tense only may receive an interpretation so that it establishes RT. It is also possible that such a sentence might share an adverbial with a sentence that did not establish RT. This would happen if, for instance, the immediately preceding sentence had a non-RT combination of tense and adverbial and had the same tense as that of the sentence in question, as in (18).

(18) Something unusual was to happen on the following day: Aunt Ada Doom was coming downstairs.

To interpret this sequence, RT is needed for the first sentence. RT could be established by a third sentence with the same tense, immediately preceding or following:

(19) Everyone was frightfully bored the afternoon of the third Sunday in May. Something unusual was scheduled for the following day: Aunt Ada Doom was coming downstairs.

The same type of sequence could be constructed for the other dependent combinations of tense and adverbial, but I shall not take time to do so here.

Although sequences like (19) may be somewhat less frequent than sequences like (17), they involve exactly the same principles of interpretation. In all cases of this type, sentences with the same tense share an adverbial. The difference is that the adverbial may occur in a sentence that is temporally complete or incomplete; the same possibilities, as in the cases above, hold for complements and independent sentences.

Sentences may also be related in the following way: one may be oriented to the other (rather than to ST). Sentences may be oriented to each other if one is a complement and the other a matrix, and syntactically independent sentences may also be oriented to other sentences. Consider, for example, (20) and (21).

(20) Mr. Neeck will announce next week that Seth betrayed him on Tuesday.

(21) The townspeople will be told some really surprising things next month: Seth betrayed Mr. Neeck in dastardly fashion, and Elfine let the bull out, and Mrs. Beetle burned the turnips.

The complement of (20) establishes past RT, but it is not interpreted as referring to a time prior to ST, that is to the Past. Rather, the time referred to is prior to the matrix sentence, which has Future RT. The principle behind this interpretation is that RT of the complement is oriented to the matrix sentence, and not to ST. The same principle applies to the relation between the first and second sentences of (21): the past tenses of the conjunction refer to a time prior to the Future RT of the preceding sentence, and not to a time prior to ST.

These examples show conclusively that sentences with past tense only are temporally vague, and that the configuration in which they appear can allow one of several complete interpretations.

c. Tense only--Present

Sentences with present tense only are vague as to RT, and the relation between ET and RT. Consider, for instance, (22) and its different interpretations in (23) and (24):

(22) Adam is driving the buggy into Howling.

(23) We can't help you with the sukebind harvest now; Adam is driving the buggy into Howling.

(24) Something unusual is happening tomorrow: Adam is driving the buggy into Howling.

The difference between the interpretation of these sequences is what one would expect, given the RT combinations presented above. Since the sentences of both sequences have the same tense, the adverbial of the first applies to the second, that is, the adverbials are shared by the second sentences.

The asymmetry of English tenses has often been noted by grammarians. In terms of the analysis presented here, the asymmetry is evident in the fact that there are no dependent combinations of tense and adverbial with present tense (with the exception perhaps of the Historical Present).

d. Habitual interpretation

There is another way in which context can force a particular temporal interpretation of a sentence. Frequency adverbials, it will be recalled, occur in habitual sentences; frequency adverbials can be shared, as the following sequence indicates, just as time adverbials can be shared. Compare in this regard (25) and its interpretation as part of the sequence (26).

(25) Seth went to the talkies at 8 p.m.

(26) The same thing happened every evening: Seth went to the talkies at 8 p.m.

Although (25) refers to a specific event, the same sentence indicates recurrence in the sequence following. Thus a sentence can receive an habitual interpretation in the context of a sentence with the same tense and a frequency adverbial.

Perhaps more frequent is the case where a sentence has tense only, and a frequency adverbial in a neighboring sentence can apply to it, as in (27).

(27) Mrs. Beetle burned the turnips. She did this every Friday evening.

These examples differ from the preceding types in that here, the independent sentences are not necessarily incomplete. However, the adverbial in a neighboring sentence shifts the interpretation from specific to habitual.

3. COMMENTS

I have shown that syntactically independent sentences may be incomplete semantically, and that neighboring sentences may provide information that allows interpretation of such sentences. This analysis is possible only in the context of careful interpretation of complete sentences, as sketched in section 1. Most of the cases of incomplete sentences are identical to situations in which complement sentences are dependent on other sentences. In fact, the rules of interpretation needed for complements can be extended without difficulty to apply to other dependent sentences. What is needed is a provision that the domain of the rules is larger than a single sentence. Just as complements may share material from other sentences or be oriented to them, so independent sentences may have a sharing or orientation relation with other sentences.

The analysis of certain grammatically impeccable sentences as incomplete explicates the feeling of many scholars that there is something wrong about trying to interpret sentences in isolation. Apparently deixis of time and place, as well as the more-familiar phenomena of anaphora, involves single sentences only as special and perhaps rather artificial cases. Many interesting questions remain, of course. One important question for future research is the characterization of "neighboring sentence." Are there constraints on how far apart such sentences may be? Do certain grammatical structures facilitate or inhibit dependence? Are there other types of dependence besides the ones considered here? (Clearly there are.) More generally, the analysis given here suggests a way of dealing with texts, as having subunits with, e.g., one RT.

I hope to have demonstrated, not only some interesting facts about semantic dependence among sentences, but the value of a precise analysis. Only with a careful analysis of complete, independent cases can one deal with phenomena of dependency and incompleteness.

FOOTNOTES

[1] For a detailed account of the analysis, see Smith 1976c.

[2] The example sentences in this paper were inspired by Stella Gibbons' novel, Cold Comfort Farm.

[3] I will use lower-case letters to refer to temporal expressions; upper-case letters refer to particular time reference.

[4] Auxiliary have is a relational expression, rather like a time adverb. For discussion, see Smith 1976b.

[5] Not all combinations occur: in specific sentences, have does not occur with present tense and a time adverbial (see Smith 1976a).

[6] Modals are treated, in this analysis, as modals; will is not a future indicator. The interpretation of sentences as Future is affected by aspect; however, aspect is beyond the scope of this paper.

[7] In cases where no preposition introduces an adverbial, the consistent interpretation is that ET and RT are simultaneous. In other words, if the preposition has no phonological shape, ET=RT.

[8] This sentence is ambiguous between the "already" reading and a reading in which Flora read the letter prior to some unknown time--not given in the sentence. It is the latter reading that is intended here.

[9] Habitual sentences are discussed in detail in Smith 1976a.

[10] Complex adverbials may be separated in the surface structure of a sentence. There are some cases of sentences having two adverbials, one separated from the sentence by comma intonation. These are treated as the result of a transformation that collapses two sentences to one.

[11] See Banfield, 1973.

[12] More precisely, ET of the matrix sentence functions as RT for the complement.

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DISCUSSION OF THE C. SMITH PRESENTATION

Robert McCoard, SWRL

I am entirely in agreement with the view that sentence interpretation depends heavily upon context, and that temporal relations involve discourse properties which we are only just beginning to identify. Reichenbach (R.) dealt with only a very limited class of temporal interactions among sentences, so it is good that Dr. Smith has undertaken to generalize the field of inquiry. My remarks here will address certain properties of R.'s formulaic analysis, and some differences between R. and Smith as they relate to the modeling of tenses.

R. uses the concept of a "Reference Point" (= Smith's "Reference Time") to explain both temporal relationships and adverbial co-occurrence patterns. The RP seems necessary, e.g., in describing the meaning of the past perfect, as in he had (already) gone, where the event-time (EP) of going was before some time (RP) which in turn precedes the present time of speaking (SP). Since in general there is only one time adverb per verb phrase, there needs to be a constraint on what P's may have an adverb associated with them, and since the adverbs that appear with the past perfect appear to identify the RP rather than the EP (so R. argues), a constraint that temporal adverbs modify only RP seems to be what is needed. This constraint can in turn be applied to rationalize the pattern of adverbs occurring respectively with the preterit (simple past) and present perfect. The appearance of adverbs like yesterday with the preterit suggests a semantic model R,E--S (that is, R simultaneous with E, both preceding S; cf. R., p. 290), while the use of present adverbs like now with the present perfect suggests a model E--S,R (event preceding both speech and reference, which coincide). The coincidence of S and R in the perfect can also be seen to imply a "current relevance" interpretation of the meaning of the perfect, though R. does not argue the point; similarly, the E,R identity in the preterit may be argued to entail a "definite time in the past" interpretation of the preterit. I have argued elsewhere that these interpretations do not work (see my dissertation, "Tense choice and pragmatic inferences: A study of preterit/perfect oppositions in English," UCLA, 1976)*, but will try to restrict myself here to points of concern to Smith's study of contextual involvements with tense.

Smith's theory assumes, like R.'s, that one RP is involved in each verbal expression, and only one. Given that the present perfect's RP coincides with SP, the present time of speaking, we would assume that the adverbs going with the perfect are the same as those which go with the present tense. This is, however, not true: compare At the moment he is/*has been away and He *is/has been away almost a week now, for instance. Hence the S,R element in the formula for the present perfect functions differently from that in the present (represented by R. as S,R,E, with all points coinciding). On the preterit side, the fact that E always coincides with R (in R.'s view), makes it impossible to demonstrate that adverbs "really" attach just to R; only the desire for a convenient consistency makes it so. On these counts, R.'s employment of an extra point, R, is not all that well-founded. Furthermore, in some compound verb forms, it appears that we need an extra reference point (R_2) to model the tense: e.g., She would have returned by Friday (if she hadn't missed her train Wednesday), assuming parallelism with She will have arrived by next weekend (I'm sure).

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*Shortly to be published by North-Holland.

Now, according to R.'s own formula for the preterit, Smith's example Old Mrs. Starkadder saw something nasty in the woodshed would necessarily represent a coincidence of E and R; but Smith has it that "the RT is not specified and we do not know the relation between ET and RT" (p. 2). It may well be that R is not specified, but we cannot let the relation of E to R be completely free, since, for example, the relation E--R--S represents the past perfect. The relation E--R--S is specified, Smith says, by adding to the example the adverb before 1929; but how then would we distinguish this from Old Mrs. Starkadder had seen. . .before 1929? Also, if we change the adverb to in 1929 in the latter version with had seen, the adverb must apply to R, but given Smith's stipulations that the preposition in the adverb "gives the relation between ET and RT" (p. 2), and in marks a "simultaneous" relation (p. 3), the E--R relation is contradicted. More to the point, the adverb in 1929 is normally understood, I think, to express the time of the seeing, E, just as it seems to do in She saw something. . .in 1929 (where E coincides with R). We know that in some cases the past perfect serves as a "shifted" preterit: She says that she saw . . . becomes (at least optionally) She said that she had seen . . . ; here the past perfect is really a "past preterit." If we assume that the preterital element E,R is preserved through the shift, then the model for the past preterit must be E,R_2--R_1--S; even if we do not retain R_2, some extra mechanism is needed to limit the free-wheeling R, or we can no longer pair meanings and forms regularly. We would not want to model she had seen, above, as E--S--R, for instance: this formula has no distinctive realization in the English tense system, being subsumed under the meanings of she will have seen, which also expresses S--E--R, and presumably S,E--R.

The applicability of adverbs to either the R or the E of a past perfect (or equivalently, to R_1 or R_2) seems to be needed anyway to account for the ambiguity in examples like The week before, he had solved all his problems, where the "free indirect speech"-type reading can be paraphrased "as of the week before, he had already solved all his problems (so he said)," as opposed to the reading in which the week before pertains to the actual event of solving. If these readings are to be structurally differentiated by attaching the adverb in one case to R and, in the other, to E, we are justified in speaking of ambiguity; if we do not assume a structural difference, it would be better to say simply that the adverb is vague in its connection to the sentence (just as Smith says that sentences depending on "neighboring sentences" to fill in their temporal specification are vague (p. 4). It may be premature to assume structural differences in any case, since disambiguation seems to depend on pragmatic factors as much as adjacent syntactic cues: though R. maintains that in *I had met him yesterday*, "what was yesterday is the reference, and the meeting may have occurred the day before yesterday" (p. 294), it seems that the usual interpretation connects the meeting with *yesterday*, the *yesterday* = R equation being much less likely, and dependent on rather special communicative contexts (compare the "free indirect speech" reading mentioned earlier).

I have argued that there is reason to allow adverbs to specify EP as well as RP (equivalently, either E, R or --R--), though this destroys the elegance of R.'s tense analysis. Such a liberalization is favored by at least one of Smith's own lines of thought. R.'s claim that adverbs never specify EP, but only RP, is retained by Smith for independent sentences, but in dependent sentences (i.e., those which are "incomplete semantically" and "have RT established by the adverbial of another sentence"), the adverbs are "available, as it were, to specify ET" (p. 5). In *Seth told Flora on Tuesday that Reuben had fallen down the well three years ago*, the adverb *on Tuesday* is "shared" with the complement clause, identifying its R, and leaving *three years ago* at liberty to serve some other function, namely specify the time of falling down the well. In addition, "the same account holds for incomplete sentences that are independent semantically" (p. 5--I believe Smith means, "independent syntactically," to judge from context). Accordingly, "ET can be specified only by a (semantically) dependent sentence," one whose own adverb is not compatible with the tense it contains, or is otiose ("only one time adverbial per sentence," p. 4) in the context of a shared adverbial. Smith points to the similarity between syntactically independent but semantically dependent sentences, and syntactically dependent + semantically dependent sentences (i.e., clauses) in this regard as striking evidence for the arbitrariness of taking the sentence as the optimal unit of grammatical analysis (p. 5). I would like to point out that there is something artificial about saying that just in case the adverb does not correspond to the particular RT involved in the sentence, or is not "needed" because a shared RT is already available, the abandoned adverb finds a home with the ET. In other words, when the constraint limiting adverbs to RT fails, we allow the ET to come to the rescue. I have previously claimed that temporal adverbs quite often identify ET, even in cases where there is nothing to prevent a reading in which it is RT that is identified, at least no structural barrier. I also claimed that the RT-constraint is not adequate to represent the pairings between tenses and adverbs, either within or among sentences. As soon as RT loses its central importance as the one and only "peg" for temporal adverbs, there is no longer any firm reason for limiting ET-specification to the class of otherwise superfluous adverbs Smith was talking about. The phenomenon of ET-specification assumes broader proportions, and it becomes even more true that semantic dependence and information-sharing disregard syntactic boundaries.

The idea that the minimal condition for adverbial sharing among sentences is a sameness of tense has been discussed (in different forms) by Allen (*The verb-system of present-day American English*, Mouton, 1966) and Kittredge ("Tense, aspect and conjunction: Some inter-relations for English," dissertation, 1969), among others. There is certainly much work to be done before we will have a viable "algebra" of tense relationships in discourse. I hope my comments will serve to suggest some areas to be looked into.

DISCUSSION OF THE C. SMITH PRESENTATION

Craig Chaudron, OISE

I think Smith is correct in suggesting that the final complete interpretation of many sentences will rely upon contextual (cohesive) factors across sentences, not to mention non-linguistic contexts, and that there are "other types of dependence" than those considered in her paper (p. 9). I think that for this reason, she makes a mistake. in trying to develop such an interpretative system for temporality based on tense and adverbials, primarily giving these phenomena the responsibility for the interpretation of RT and ET, not to mention ST.

Concerning the "interpretation" of temporality, I found that it was often unclear exactly from what one would infer the proper RT, ET, or ST. The interpretation of ST Smith claims can be inferred from RT, and yet in her sentence (1), one requires the knowledge (presumably from earlier text) that ST is not 1929; there is no other reason to assume that 1929 is in the past. It is not clear what would make 1929 the RT, and in fact Smith says, in an apparent contradiction, that "tense and time adverb establish RT" (p. 2). Her statement that "ET and RT are the same" in (1) is therefore unclear. To me, ET is still quite unspecified. Further, it may be a dialectal difference, but I don't think it is necessary to interpret (2) as having an ET prior to "last week" (cf. "Cornelius fell down the well yesterday, Jeb fell down the well the day before, and in fact Jeb had already fallen down the well last week."), unless it would say "by last week." Thus, the ways in which context can determine RT, and then ET, are rather more complex than is apparent in these "complete" sentences.

Another example of contextual effects belies Smith's proposal that an incomplete sentence is interpretable if a preceding sentence has the same tense and an adverbial. She claims that (17) does not allow complete interpretation of (15), but that "what is needed for interpretation is a sentence that has the same tense and a time adverbial." (p. 6) However, supplying these in the first half of (17) doesn't help: "Aunt Ada Doom was coming downstairs at 5 o'clock. Jeb Starkadder was throwing crockery." That is, she heard him and wanted to stop him (throwing precedes coming), or he was scheduled to do so, and she wanted to see it (coming precedes throwing), or any number of temporal nuances. The real interpretation has to do with what kind of causal interpretation one makes between the two sentences. It may be that a common tense and an adverbial are necessary, but they are far from sufficient.

A further problem is evidenced in the two sentences (18) and (19), which Smith claims differ with respect to the specificity of RT. Actually, (19) is no more specific with regard to RT than (18). Sentences (18) certainly have their RT specified (as did "Aunt Ada Doom was coming downstairs" have its RT specified by "Something unusual. . ., etc. . ."), but (19) is non-specific just as (18) was--we need to know the year, and then perhaps the calendar conventions being used, etc. If we assume that we are normally dealing with "possible worlds," especially in novels, one could imagine an infinite regress of RTs.

I don't find the explanation of ET any more clear. It will apparently depend on topicalization phenomena, since it is the time "at which the relevant event or state occurs" (p. 1, my underlining). But it is not clear whether ET is to be interpreted for each sentence (perhaps left vague or unspecified, but still interpreted somehow at the end), or only for an entire sequence. (11) through (13) are examples: are we talking about two separate (although perhaps simultaneous) ETs, or does the contextual relevance make only one sentence have ET? Smith appears to work within the former possibility, yet the discussion in 2d (p. 8), which is actually a discussion of ET, would suggest that the interpretation is as a larger unit. Smith says, regarding (26) and (27), that "the adverbial in a neighboring sentence shifts the interpretation from specific to habitual." Here, the question of topicalization is crucial, for whereas (26) probably does have one interpretation (habitual), (27) seems to have two. "Mrs. Beetle burned the turnips" is still a statement about a specific event, as far as we know, despite the fact that the following sentence describes an habitual event.

A quite different fact arises in the interpretation of several of the example sentences, owing to the large influence here of lexical items on temporal interpretation; Smith appears to have neglected to control for the semantic implications of various lexical items. Note how (4) is immediately interpretable as having Present tense without the adverbial, whereas (5) is vague (or bivalent). Highly descriptive verbs like "lurk," "creep," "smother," and "whisper" can not usually be used in present continuous without Present interpretation, while other verbs like "ship out," "throw a party," and even "going to" (notice the more unmarked "on one's way" for the Present sense of "I'm going to the fair"), will usually imply Future when in present continuous. Likewise, non-linguistic knowledge normally allows an interpretation of Present for "He's burning the toast," but leaves vague the interpretation of "He's burning the hay," solely because of expectations concerning "hay," "toast," or "casserole," etc.

RESPONSE TO DISCUSSION

Carlota S. Smith

I would like to begin rather apologetically by emphasizing the brevity and therefore the sketchiness of my paper. A rather complicated system for dealing with temporal specification had to be summarized, since it provides the basis for my suggestions about dealing with relations between sentences. The summary left out a great deal and, I'm afraid, did not convey my awareness of the many aspects of the topic that were not covered. Readers who wish a more complete discussion are referred to my paper in Linguistics and Philosophy.[1]

This aside, I would like to say that I agree with many of the comments of Chaudron and McCoard. In particular, I make no claim that the relations between tenses and adverbials exhaust the phenomena that are relevant for consideration of temporal relations between sentences. As Chaudron says, they may be necessary but are not sufficient: there are many other factors. I do claim that the other factors cannot lead to an interpretation that is not compatible with the temporal information given by tense and adverbials. For some relevant discussion, see my paper in the most recent CLS volume.[2]

I now turn to specific comments. Chaudron's comments:

a) Interpretation of example 1. In the version of the paper that was circulated, this example was incorrectly reproduced: the adverb, which should have been in 1929, was given as before 1929. This unfortunate error may have led to some misunderstanding. Chaudron comments that the pastness of 1929 is not established, and that ET is unspecified. According to the system outlined in my paper, it is the combination of past tense and Unanchored adverbial that indicates the pastness of 1929 relative to ST. I agree that in the example Chaudron saw, ET is unspecified--what is specified is its relation to RT, anteriority (in the incorrect version of the example).

b) The specificity of RT in examples 18 and 19. I agree that the amount of calendar and clock information that is necessary and relevant shifts, according to context and genre; the temporal information given in 19 is indeed not sufficient to unambiguously fix RT. Just how much information is required in what contexts seems outside the domain of linguistics, but rather that of pragmatics since the information may be shared but never appear explicitly in a given context.

c) I think that Chaudron is correct about the interpretation of 27; others have pointed out the same facts to me. However a better example, on the pattern of 26, could easily be constructed, so that I think the point--the potential ambiguity with respect to habitual vs. specific reading of many sentences--is not seriously vitiated.

McCoard's comments:

a) Adverbs. I believe that McCoard and I are in substantial agreement about temporal adverbs and how they relate to reference points; since the publication he refers to is not available to me, I cannot discuss his specific proposals. He suggests that adverbs do not specify only RT; I make the same suggestion in the paper, in the discussion of sentences that are syntactically and/or semantically dependent on other sentences. McCoard comments that my treatment is artificial. It seems to me, on the contrary, that the treatment brings out just how the syntax of English constrains the semantics of temporal specification. The facts that only one time adverbial can appear in a given sentence, and that knowledge of RT is essential to interpretation, explain why ET (if different from RT) can be specified only in a sentence that shares a time adverb with another sentence.

b) McCoard suggests that an extra reference point is needed "for tense in some complex verb forms." One of his examples is a conditional and the other is not, so that the parallelism between them is by no means complete. However, I think that neither sentence requires an extra reference point: both involve two sentences, two main verbs, two time specifications. There is not requirement that two time specifications in related sentences have the same reference points. (Actually, I would analyze the first sentence of the conditional as dependent on the second--this is why both have the same tense. But since semantically *would* is not past, there is no pastness in the semantic interpretation of a conditional unless an explicitly Past indication appears.)

c) Several of the examples discussed by McCoard have auxiliary *have*. I had not time in the paper to explain my treatment of this form fully, although it is available.[3] Auxiliary *have*, a verbal auxiliary syntactically, semantically functions like an adverbial, I have argued: *have* indicates that ET is anterior to RT. Just as adverbs embedded under a temporal adverb specify a complex RT (cf. *Bill arrived after Mary left when Tom broke the glass*--the material following *after* specifies RT), adverbs that occur in sentences with auxiliary *have* specify RT. The present perfect is an exception, because *have* can occur with specification of ET--as in some of the semantically dependent sentences in the paper; in this respect *have* differs from adverbs that indicate anteriority.

McCoard says that one would expect the adverbials to be the same in both present and present perfect sentences, since for both RT=ST. However this ignores the fact that they differ in the relation between ET and RT: the two are simultaneous in the present, whereas ET precedes RT in the present perfect. The first of McCoard's examples is starred, but I find it entirely grammatical; in the second the adverb pertains to ET and depends on auxiliary have.

d) I agree about the ambiguity of sentences like McCoard's example with a week before. It seems to me that one advantage of the system I propose is that it accounts for such ambiguities.

FOOTNOTES

[1] Smith, C. S. The syntax and interpretation of temporal expression in English. Linguistics and Philosophy, 2.1, 1977.

[2] Smith, C. S. The vagueness of sentences in isolation. Proceedings of the 13th Regional Meeting, Chicago Linguistics Society. Chicago, Illinois, 1977.

[3] Smith, C. S. A theory of auxiliary have in English. Indiana University Linguistics Club, 1976.

DISCUSSION OF C. SMITH'S RESPONSE

Robert McCoard

My comment about "artificiality" was directed at the claim that the only way an ET can be specified is for it to be different from the RT, and for there to be an RT-specifying adverb "shared" with another sentence. In the first place, since the preterit is defined as having coincident ET and RT, how can one show it is not the ET that is modified by an adverb? In fact, it is the constraint against ET-specification that dictates the analysis of the tense. In the second place, if "style indirecte libre" sentences like (14) are equivalent to direct-speech sentences, why is it that a preterit, when embedded, loses its coincident RT? To take a simpler example from Jespersen (1931, IV, 151), "I saw her on Tuesday" (ET,RT--ST) is reported via "back-shifting" as "He said he had seen her on Tuesday" (ET--RT--ST). Since Tuesday refers to the act of seeing in both cases, it is clearly necessary to allow the adverb to modify the ET in the reported version. But now what if we model this latter via the formula ET,RT_1--RT_2--ST; it is no longer necessary to say that it is ET that is modified. (This formula also allows us to distinguish a backshifted preterit, that is, a "past preterit" or "plupreterit," from a true "past perfect," backshifted from have seen, represented ET--RT--ST.) Here, by allowing more than one reference time, we are able to preserve the original constraint against ET-specification. This is not necessarily what I would choose to do; the point is that by juggling your assumptions about the underlying representation of tenses, you come up with different sets of adverb constraints; conversely, choice of constraints bears on the representation of tenses.

Smith comments that the present perfect can occur with specification of ET, as in some of her dependent sentences; I have not been able to find any instances of present perfects (only past perfects), but it is true that present-perfect adverbs are a different (though overlapping) set from present-tense adverbs--a fact not accounted for under Reichenbach's assumption that adverbs map only onto reference points, and the RTs of present tense and present perfect are both "present." To account for the difference in adverb co-occurrences, Smith brings in the relation between ET and RT as a controlling factor. This will do the job alright, but it injects into the model a powerful new mechanism for mapping adverbs onto verb structures. It is like saying, "In the context of a past-ET, the present-RT may take this particular set of adverbs," or else "given an ET preceding an RT simultaneous with ST, select from this set of adverbs." Notice this set is not the intersection or union of other sets, so the mapping is still not explained. In fact, traditional theories about tense may be a subset of theories generated in this manner. (Cf. Darden, fourth Chicago Linguistic Society papers (1968), p. 16.) The question remains of how to set up general constraints on structural analyses, and how to relate contextual elements to them in precise ways.

ADDITIONAL RESPONSE

Carlota S. Smith

Apparently McCoard has not accepted the point that, in my analysis, combinations of tense and adverb establish reference time. Adverbs function differently in different configurations, then: either they contribute to establishing RT, or they establish ET. They do not modify either ET or RT. When ET=RT, both are specified in a given sentence (assuming that the sentence has enough information to establish RT). If ET differs from RT, the former can be specified only in a dependent sentence. This analysis is really due to the mismatch between the syntax of English and the semantics of temporal reference: English allows one time adverb per sentence, and temporal reference may involve two times.

DISCOURSE STRUCTURE FROM AN ARTIFICIAL INTELLIGENCE POINT OF VIEW

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This paper presents an overview of a theory of discourse structure which relies on a set of cues to provide links between sentences of the discourse. The frequency with which these cues are found in newspaper articles is examined. The model of discourse presented here is part of a larger project on the representation and use of knowledge which is currently being developed by the Cognitive Compacting group in the Artificial Intelligence Lab at M.I.T. For a more formal discussion of this project see Goldstein and Roberts (1977), or Bullwinkle (1977). Although the present paper focuses on discourse, our project also involves a reasoning component and the development of frame-based semantics. All these parts are intended to work together to understand textual material. Examples of frame structures are presented to demonstrate the natural link between this form of knowledge representation and the model of discourse structure.

The Model

If understanding connected discourse can be viewed as combining the meanings of individual sentences, then the placing of new information from successively read sentences into some conceptual structure becomes the fundamental operation. Rules for handling text should take advantage of the information available in the text itself. I believe that new sentences are related to previous ones through their assimilation to the themes of the discourse. Each new sentence is potentially concerned with one of a relatively small set of themes. Consequently, in processing each sentence only a small ordered set of alternatives is considered. Since new sentences are linked to previously introduced themes, the thematic organization provides the control structure. For instance, if we know that a paragraph discusses a particular sub-theme, we need only try to infer how the sentence meanings are linked to this sub-theme, while ignoring other aspects of the story database. Thus the discourse themes provide an organized set of topics with which each new sentence must be interfaced. So far, I have not said anything concerning discourse structure which would not be generally accepted. However, by introducing the concept of a Frame (Goldstein & Roberts 1977) we can start to formalize the notion of a theme. Specifically, a theme of discourse, in the frame model, is a Frame whose slots are expected to be instantiated. (Later on I will provide details as to the nature of Frames.)

It is also useful to propose a restricted set of ways a sentence might be related to a particular theme. These provide a small set of likely alternatives to use when trying to assimilate a sentence to a particular theme. This too can be given a precise specification in terms of Frame theory.

The more explicit the discourse link, the easier it is to focus the understanding process on assimilating sentence meanings which should be linked, rather than on trying various alternatives to see if they may possibly be related. The usefulness of theme structure and thematic expectations will be determined by the ease with which various cues in the sentences can be used to indicate intersentence thematic links. These cues provide the initial focus for the understanding process by directing its attention to the particular linkages it should attempt to create.

Discourse Links

Let us consider the various types of cues available for integrating thematically related sentences. These cues are used by a program under development whose goal is to construct a thematic structure and story data base from a text. It attempts to link each new sentence to some part of the existing theme structure. In doing so it examines that sentence looking for information on the nature of the link. To correctly link a sentence meaning with its particular related theme, the program assumes first that there exist only a small number of types of cues in sentences indicating the thematic link, and second that every sentence contains such a link. (Of course, in less than very well written text this is not always true. To the extent that this does not occur, the text is more difficult to understand, precisely because inferencing must be done to determine how what is said in one sentence relates to prior sentences.)

In approaching the problem of discourse structure, I have chosen to focus on intersentential links which can be computationally specified in a program. However, these do not form an exhaustive set. As ways of implementing other sorts of cues arise, they will be used. Unfortunately, while there is general agreement on many of the kinds of knowledge used in understanding discourse, few of these ideas have been worked out in enough detail to be useful in building an actual discourse processor. I have chosen an intermediate level which I believe is relatively powerful, and which reflects my bias towards viewing discourse structure as a problem solving activity rather than a linguistic issue. My initial choice does not draw on the excellent work which has been done on cues such as anaphoric reference (Nash-Webber, 1976; Hankamer & Sag, 1976), cleft and pseudo-cleft sentences (Carpenter & Just, 1977), noun phrase reference (Bullwinkle, 1977), conversational postulates (Grice, 1967), functional sentence perspective (Kuno, 1975), the topic-comment distinction (Moore, 1967), and compiled phrases (Becker, 1975).

The types of linking cues I have chosen are (A) Paraphrase; (B) Contextual Reference; (C) Frame reference; (D) Default.

A) Paraphrase allows a referenced object to be directly evoked by using a label. This has several advantages. The sentence in isolation can be perfectly understandable, with all objects given names.

If the referred-to objects already exist in long term memory, skimming becomes a much easier job, since each sentence can stand alone. Representations for data structures will have a variety of labels, known as PARAPHRASEs. To explain my use of paraphrase I will introduce some semantics. Specifically, consider how a concept (I will later provide a formal representation for a concept) could be referenced. It might have a name. For example, the concept for the Oil Cartel might have the name "Oil Cartel." Whenever it comes across this name in text, the program references the concept, if it already exists in the story data base, or else it retrieves this concept from long term memory and adds it to its database for the text. Suppose the text understander after reading a sentence with "Oil Cartel" as its topic, then reads a sentence containing "O.P.E.C." Presumably this also is a name for the same concept. There may be other names which are used as unique designants of the concept. We can think of these different PARAPHRASEs as all being permissable labels of the concept. However, the use of a paraphrase, unlike a pronoun, does not presuppose that the concept already exists in the story database. The sentence is understandable even if this is not the case, with the paraphrase serving to evoke the concept. Each concept will have an associated list of allowable labels which directly access the concept. (This holds both for concepts which are used to represent objects or things (Oil Cartel) and for concepts which are used to represent events. For instance, we have "the Oil Crisis," "Oil Embargo," etc.)

B) Contextual Reference is closely related to paraphrase. Contextual reference is the use of a descriptive term in a context where it functions as a reference or paraphrase. In the following sentences

(S1) The report discussed the recent border clash.
(S2) The incident was not considered important.

the use of the phrase "The incident" in (S2) is an unambiguous reference to the "border clash" of the first sentence. In the context of the discourse, only the "border clash" is an incident. Other contexts might result in the phrase having a different referent. Consequently contextual reference involves the use of a general term in a context where its referent can be uniquely disambiguated. An interesting phenomenon is that repeated use of a particular contextual referent in a text causes it to become a local paraphrase. After its initial introduction, "incident" would refer to the "border clash" throughout the text. Such local contextual referents can be saved to reduce later processing. If "incident" also had associated paraphrases these would also reference "border clash" in the context of the text. A sub-class of this category is the use of more or less generic names as references (e.g., "gun" vs. "forty-five caliber automatic pistol").

Up to this point I have not specified a symbolic representation for a concept. A concept has a set of attributes. This is common to most representation schemes. Following the knowledge representation language developed by Goldstein and Roberts (1977), I shall refer to the representation of a concept as a frame, an attribute's name as a slot, and its value as a datum. This allows us to define FRAME REFERENCE.

C) Frame Reference refers to a form of reference which depends on the empty slots of a frame for effect. It operates either within or between sentences, and illustrates that the processing of intersentence links is not separate from intrasentence processes. For an example using case frames, consider the following two sentences.

(S3) John shot his wife.
(S4) The gun was a forty-five caliber automatic.

In this case the sentences can be linked through the realization that the action of the first sentence ("shot") has an unspecified instrument. The second sentence specifies this instrument. Suppose a sentence like

(S3a) His motive was jealousy.

is interposed between the two sentences (S3) and (S4). We still have no difficulty in linking them. Consequently, the scope of the case expectations can extend over more than one sentence, although at some point, perhaps when an intermediate theme has been introduced, they will become difficult to disambiguate.

A basic approach of our group is to map the surface case information produced by a parser into a deep case structure (which we call a frame). This deep case structure may contain information from several sentences, as well as "cases" not normally associated with surface case structure.

E) Default I propose as a rule of discourse that if there is no explicit link to a previous theme, the current sentence will discuss the same theme as the preceding sentence. This is referred to as the DEFAULT option. This allows us to treat our cues as a complete closed set.

To determine how well these categories covered the field of discourse links, and their relative frequency of occurrence in well written text, I examined several newspaper articles. Newspaper articles provide a good domain, since they have evolved under very practical constraints into prose which provides a maximum of information in a minimum of space, in a format which is one of the most easily understandable.

The articles were chosen from the New York Times. The procedure was to take one front page article a day for several days, and count the frequency of occurrence as a thematic link of each of our cues. A total of eight articles were examined in this way. In addition, the occurrence of anaphoric intersentence links was tabulated to determine the usefulness of the cues. Table 1 shows the frequency of occurrence of the various types of cues. No instances of FRAME REFERENCE as a thematic link happened to occur in these particular articles, and so this category is omitted from the table. Only about one fourth of the intersentence references were anaphoric in nature. This is not surprising since

Table 1

	Article Number							
	1	2	3	4	5	6	7	8
ANAPHORIC	14	3	18	7	8	8	4	6
PARAPHRASE	21	9	3	11	9	15	18	11
CONTEXTUAL	3	7	3	9	6	10	10	6
DEFAULT	2	5	5	5	8	7	4	4
Total number of sentences	40	24	29	32	31	40	36	27

Rosenberg and Lambert (1974) had found that articles with many intersentence anaphoric references were more susceptible to processing difficulties than those with few such links. All sentences which did not use anaphora as the intersentence link contained one of the other cues.

To further explore the use of these cues, three articles were examined intensively, and their thematic structure charted. I wished to determine if some cues were used under different circumstances than others. Consider the nature of theme structure organization. The two possible dimensions are depth and breadth. In other words, a depth first thematic organization would first introduce a sub-theme, discuss it exhaustively, and then pop back up and introduce a new sub-theme, without ever returning to a previous sub-theme. A breadth first theme structure would first introduce all sub-themes, then talk about one, go on to the next, and so on. After saying a few things about all sub-themes, it would return to the first, and say a few more things about it, then go on to the next, etc. This process would repeat itself to some arbitrary level of depth. Actual prose is a combination of these two strategies. In either case, local groups of sentences discuss some sub-theme. At some point it becomes necessary to "pop up" and switch to a new sub-theme. An interesting question is whether links between sentences with different themes are of a different sort from those used locally within a group of sentences which discuss a single theme.

To answer this, a numerical value was assigned to each cue in the three articles. Those links which were "local" were given a value of 0, while those used in "popping up" or otherwise linking a theme with other themes were given a value of 1. A "local" theme link can be defined as a link to the most recently referenced theme. A non-local link then either refers to some prior theme or introduces a new theme. The mean value associated with each cue indicates the uses to which that cue is put. (DEFAULT cues are not included in this statistic since they are by their nature local cues.) Table 2 shows the results.

Table 2

	ARTICLE 1		ARTICLE 2		ARTICLE 3	
	Nbr. Sent.	Mean Value	Nbr. Sent.	Mean Value	Nbr. Sent.	Mean Value
ANAPHORIC	4	0	3	0	5	0
PARAPHRASE	8	.75	14	.36	14	.43
CONTEXTUAL	6	.17	11	.45	8	.50

These results indicate that in our sample anaphoric reference is never used to indicate cross theme links. While the sample is quite small, it seems that our discourse cues will be useful in handling discourse links, particularly those between themes. I will formulate a rule, Rule 1, which states that: the understander expects every sentence to contain at least one explicit cue (i.e., PARAPHRASE, CONTEXTUAL REFERENCE, ANAPHORIC REFERENCE, or FRAME REFERENCE) which indicates the link to the theme structure, otherwise the DEFAULT option holds true.

Comprehension

Once a link is found, a sentence may be related to a prior theme in many ways. The most important of these ways are: Rule 2: A sentence is either:

A. Instantiating the concept description of that theme.
B. Augmenting expectations for attributes of the concept.
C. Providing reasoning knowledge involving that theme.
D. Introducing a new concept as the value of some attribute of the current concept.

These are not exclusive. More than one choice can occur in a sentence. Let's consider these four alternatives.

(A) Instantiating a concept description of a theme. The theme can either be an object ("Oil Cartel") or an event ("Oil Crisis"). In either case a FRAME is used to represent the theme. So far, all that I have specified for a FRAME is a property list, some of whose properties are cases. Following Goldstein and Roberts (1977) by a FRAME I mean a "generalized property list." This property list can be thought of as a deep case frame, into which the surface case information produced by a parser can be mapped. Suppose that the theme is the act of murder expressed in the sentence

(S5) John murdered his wife Mary.

Further suppose that our frame for murder initially contains at least that information which the verb "murder" has associated with itself in a case grammar. One such case will be the instrumental. In the sentence this case is unfilled. This will often happen. Such defaulted frame slots are UNINSTANTIATED. INSTANTIATING a theme involves substituting actual values given in sentences for default values. The understander expects that in a piece of discourse all uninstantiated slots for a theme will be instantiated somewhere in the course of the article. New knowledge in a current sentence related to that theme may instantiate part of it.

Thus Uninstantiated slots create EXPECTATIONS. The understander EXPECTS these slots to be instantiated by information in succeeding sentences. Our model of discourse understanding views the process as an active one. Once a link has been found between the current sentence and a previous theme any expectations associated with that theme become active processes which examine any new knowledge in the sentence in an attempt to instantiate themselves. (This idea of using active processes to make sense out of new input is not a new one in A.I. [e.g., Charniak, 1972; Minsky, 1975; Goldstein & Papert, 1975]. I propose that these active expectations used in understanding text are organized around frames, and controlled by the thematic structure. This determines which expectations are actively being considered at any one time.) Of course, in any particular text, not all expectations will be instantiated, but this is not important. Rules 1 and 2 have the effect of reducing the alternatives considered. They state that any new knowledge in a sentence is related to only a few aspects of the prior context, and that by examining cues in the sentence these aspects can be discovered. Thus, for each new sentence, only a small number of alternatives are ever actively considered. The sentence currently being processed should indicate which theme is relevant. The frames for that theme will contain a number of expectations. The function of discourse structure is precisely to limit the number of alternatives which have to be considered.

(B) Augmenting expectations. The process of instantiating expectations may also result in the following alternative. Although a new sentence may not actually instantiate an expectation, it might help us by providing further information about the form of that instantiation. For instance, so far we have been using selectional restrictions on cases in our frame to define a permissable slot filler. This is a very crude filter. Consider the expectation for an instrumental case in (S5) again. Suppose the next sentence said:

(S6) He used a blunt instrument.

Although the case has not been instantiated, in the sense that a particular object has not been specified, we now know that a semantic feature of the instrument is that it is blunt. This can be encoded in the frame as a requirement on the instrument slot of the murder frame. Consequently our expectation has been AUGMENTED by the knowledge in the new sentence.

The expectation is an active problem solving process which can make use of this requirement in trying to find a datum to instantiate the instrument slot. If the third sentence said:

(S7) A frozen leg of lamb and a vial of poison were found next to the corpse.

the expectation can now instantiate the instrumental case with "leg of lamb." Consequently, discourse often gives clues concerning the semantic features of an instantiation, which are useful in recognizing the actual slot datum.

(C) Reasoning knowledge. Some sentences do not instantiate a theme, but instead provide reasons, causal links to previously described events, etc. I will call such information REASONING KNOWLEDGE. Such knowledge often expresses a simple causal relation in a non-quantitative fashion. Some examples are:

(S8) He murdered her out of jealousy.
(S9) Poor rain this winter means a reduced winter wheat crop.

(S8) could of course be represented in the murder frame by assigning "jealousy" to a motive slot, should we choose to use such a slot. However, in many cases, as in (S9), we would prefer to have the sentence trigger the reasoning component to modify the current frame using the knowledge in the sentence.

(D) Sub-themes. The term theme may have been used in a confusing manner. Every sentence designates at least one topic, but not all topics are themes. The designated topic is a deep case frame which is moved into the story database. If the topic contains no new expectations, it is merely instantiating a previous theme (i.e., it is assimilated into an existing deep case frame). If it does contain new expectations, it is considered a new theme. In other words, Frames which have forward consequences across sentence boundaries are considered to be themes. At various times when discussing a particular theme, an article may introduce a related theme or sub-theme. This alternative can be made more precise. A new theme has been created if the sentence introduces any new expectations.

Frame Based Semantics

A parsing scheme which can function as input for a system of discourse rules such as are presented here must provide case information as well as a syntactic description. These surface case descriptions are mapped into deep case frames. The deep case frames can be viewed as being part of a broader frame system.

Surface case frames are ordinarily defined in terms of the selectional restrictions on the cases a verb may take. The deep case frames will also contain slots for further cases, paraphrase labels, links to related frames, pointers to generic information, as well as computational knowledge. Additional processing on noun phrases or clauses which specify particular cases will allow substitution of computed values for the phrase or clause structure (e.g., substituting the current time for the time case value specified by the phrase "at this time").

Goldstein and Roberts (1977) have developed a working frame system which forms the basis for this semantics. Within the frame system, a slot can be further specified through the use of associated "Keys." Each slot in the frame may have an arbitrary number of user and system defined "Keys." Useful system defined keys are the $Val key, which contains the value of that slot; the $Def key, which specifies a default value; $Req, which specifies requirements which any value for that slot must meet; $To-Add, which specifies procedures which must be run to add a value to that slot; and $If-Added, which specifies actions to be taken if a value is added to that slot. Knowledge about augmentations and expectations is contained in the keys associated with a slot. Using this knowledge the program will generate the particular expectations required, determine if a value meets the requirements, and access any associated computational knowledge.

As we have seen, there is a natural link between the structure of an individual frame and such notions as expectation and instantiation. The frame system also organizes relations among frames in a fashion which allows easy and natural implementation of semantic relations. Since slots contain frames as values, frames are of course linked through this association.

The frame system provides a slot (which each frame must have) called an AKO (A Kind Of) slot. Thus each frame is specified as a kind of another frame. Starting from a top node, the semantic network is organized as a tree structure. Generic information is "bumped" to the highest possible frame in the tree. Lower frames can inherit from this frame and also contain idiosyncratic information, and restrictions on the inheritance. For instance, consider the frame for the concept "Oil Cartel." The frame for cartel is instantiated for the domain of oil. The frame for the Oil Cartel will have requirements for the semantic features of any member by inheriting from the cartel frame the generic knowledge which specifies the features of a cartel as a group of countries banded together politically for gain. Specific requirements on members concerning the involvement of oil are encoded directly in the frame using the $Req Key of the Member Slot. There will be a membership list of actual countries which belong to the cartel, and fit the criterion. These will be values of the $Val Key of the Member Slot. As another example, consider a set of frames for the event class of Transfer. The top-most frame might be:

```
(fassert Transfer
(ako ($val (transaction)))
(actor)
(recipient)
(object))
```

A transfer then consists of an actor, recipient, and object, properly assigned to slots in the frame. We can now define two other frames in this event class which use the Transfer frame. These are the Exchange, and the Buy frames, e.g.,

```
(fassert Exchange
(ako ($val (transfer)))
(actor)
(recipient)
(object1)
(object2)
(transfer1 ($req (must-be transfer :actor :recipient :object1)))
(transfer2 ($req (must-be transfer :recipient :actor :object2))))
```

Thus an Exchange consists of a cast of characters (actor, recipient, object1, and object2), and two transfers. These transfers have requirements which specify how the cast of characters of the Exchange frame map onto the slots of the Transfer frame. The following Buy frame shows how a concept is specified making use of inheritance. The Buy frame inherits all properties of the Exchange frame through the AKO slot. All that is necessary to define a buy is to specify the unique property which distinguishes buying from other sorts of exchanges. Thus the Buy frame specifies that one of the objects in the Exchange frame must be a kind of Money.

```
(fassert Buy
(ako ($val (exchange)))
(object2 ($req (must-be 'ako 'money))))
```

To conclude, using a formal frames-based knowledge representation scheme, it is possible to specify processes for determining certain classes of intersentential links. Together with a model of discourse processing whose components can also be computationally specified, they form a first specification of a text processing module.

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Editor's Note: Comments on the preceeding paper by Rosenberg are included with the discussion that follows the next paper by Finn.

CAN RULES BE DEVISED TO MAKE IMPLICIT INTER-SENTENCE CASE RELATIONSHIPS EXPLICIT?

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The case grammar proposed by Fillmore (1968) has been used by Fredriksen (1972; 1975), Meyer (1975), and Finn (1973a; 1973b; 1975) to analyze sentences in written prose passages. The present paper proposes a model of discourse comprehension based on the hypothesis that case relationships can be specified between sentences as well as within sentences. Suggestions for discovering the rules by which language users establish these between sentence case relationships are provided.

The model proposed here is that language cognition is in part a process of assigning values to variables which correspond to "a set of universal, presumably innate, concepts which identify certain types of judgments human beings are capable of making about events that are going on around them, judgments about such matters as who did it, who it happened to, and what got changed." (Fillmore, 1968, p. 24) This is, of course, Fillmcre's definition of case relationships. In the discussion I will use the six cases suggested by Fillmore (Agentive (Agt), Instrumental (Inst), Dative (Dat), Factitive (Fac), Objective (Obj), and Locative (Loc) plus one other (Temporal (Temp)).

A Two Dimensional Model

One can imagine a row of variables in the mind of The Subject who has not yet encountered the discourse. In this state, State A, all variables are set at zero. (See Figure 1.)

State A

Verb	Agt	Inst	Dat	Fac	Obj	Loc	Temp
0	0	0	0	0	0	0	0

Figure 1. Model of Comprehension before Discourse Begins

The Subject reads Sentence 1 and assigns values to variables. He has now arrived in state B. (See Figure 2.)

1. A cat was run over last night.

State B

Verb	Agt	Inst	Dat	Fac	Obj	Loc	Temp
run over	?	?	cat	X	X	?	last night

Figure 2. Model of Comprehension after Sentence 1

Once The Subject has encountered the first sentence of discourse, all variables assume a value or they are set at ? , (meaning that with the verb of this sentence, this case may assume a value) or at X (meaning that with the verb of this sentence, this case cannot assume a value).

The verb is run over. Dative (animate, affected by action) is set at cat. Temporal is set at last night. The additional judgments The Subject is capable of making relative to kill are who did it? With what? Where? Therefore, The Subject's corresponding variables, Agentive, Instrumental and Locative, are set at ? , knowable but unknown. The Subject is not capable of making the judgment "what object or being resulted from the action" relative to run over, so the corresponding variable, Factitive, is set at X, irrelevant or unknowable.

Part of learning language is learning the case frames of verbs. When one encounters a verb he sets the corresponding case variables to known, ? , or X on the basis of his knowledge of what cases may appear in the case frame for that verb.

When The Subject reads Sentence 2, he arrives at State C. (See Figure 3.)

2. Jones was drunk and driving his car down Main Street.*

State C

Verb	Agt	Inst	Dat	Fac	Obj	Loc	Temp
run over	(Jones)	(Jones' car)	cat	X	X	(Main St.)	last night
drunk	X	X	Jones	X	X	(Main St.)	(last night)
driving	Jones	Jones' car	X	X	X	down Main Street	(last night)

Figure 3. Model of Comprehension after Sentence 2

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*Since Sentence 2 is two deep structure sentences it takes up two rows in the model.

The variables in parentheses related to run over are assigned as a result of reading Sentence 2 and the variables in parentheses related to drunk and driving are assigned as a result of having read Sentence 1.

But one must allow for the fact that in processing discourse case values assigned between sentences are tentative. For example, Sentence 3 would necessitate a revision of State C resulting in State D. (See Figure 4.)

3. Smith swerved to avoid Jones and ran over the cat.

State D

Verb	Agt	Inst	Dat	Fac	Obj	Loc	Temp
run over	(Smith)	?	cat	X	X	(Main St)	last night
drunk	X	X	Jones	X	X	(Main St)	last night
driving	Jones	Jones' car	X	X	X	Main St	(last night)
swerved	Smith	?	X	X	X	(Main St)	(last night)
avoid	Smith	?	X	X	Jones	(Main St)	(last night)
ran over	Smith	?	cat	X	X	(Main St)	(last night)

Figure 4. Model of Comprehension after Sentence 3

One must also allow for cases where a noun is named in the discourse which could conceivably fill ? cells in another row, but where such an inference is remote. Given Sentences 4 and 5, for example, the asterisked cells in State E are doubtful--perhaps highly improbable. (See Figure 5.)

4. A cat was run over last night.
5. Mark knew it.

State E

Verb	Agt	Inst	Dat	Fac	Obj	Loc	Temp
run over	(Mark*)	?	cat	X	X	?	last night
knew	X	X	Mark	X	it (cat run over)	X	(last night*)

Figure 5. Some Improbable Case Values Assigned Between Rows of the Model

In the following section the model is elaborated to explain when case values are inferred between rows and when they are not.

A Three Dimensional Model

The third dimension in the model contains lexical features of the Verb and Case cells of the original model. The model uses three categories of features proposed by Katz and Fodor (1964). An illustrative example is the lexical entry for the word bachelor as used in the sentence Having been jilted, John remained a bachelor. (See Figure 6.)

bachelor

grammatical markers	+ Noun + Common + Count
semantic markers	(+ Human) (+ Male)
distinguishers	[who has never married]

Figure 6. Lexical Entry for Bachelor Showing Three Categories of Features

The three dimensional model of comprehension for a subject who had not encountered a given discourse is represented by Figure 7.

The three dimensional model of comprehension of The Subject after he had read Sentence 1 would be represented by Figure 8.

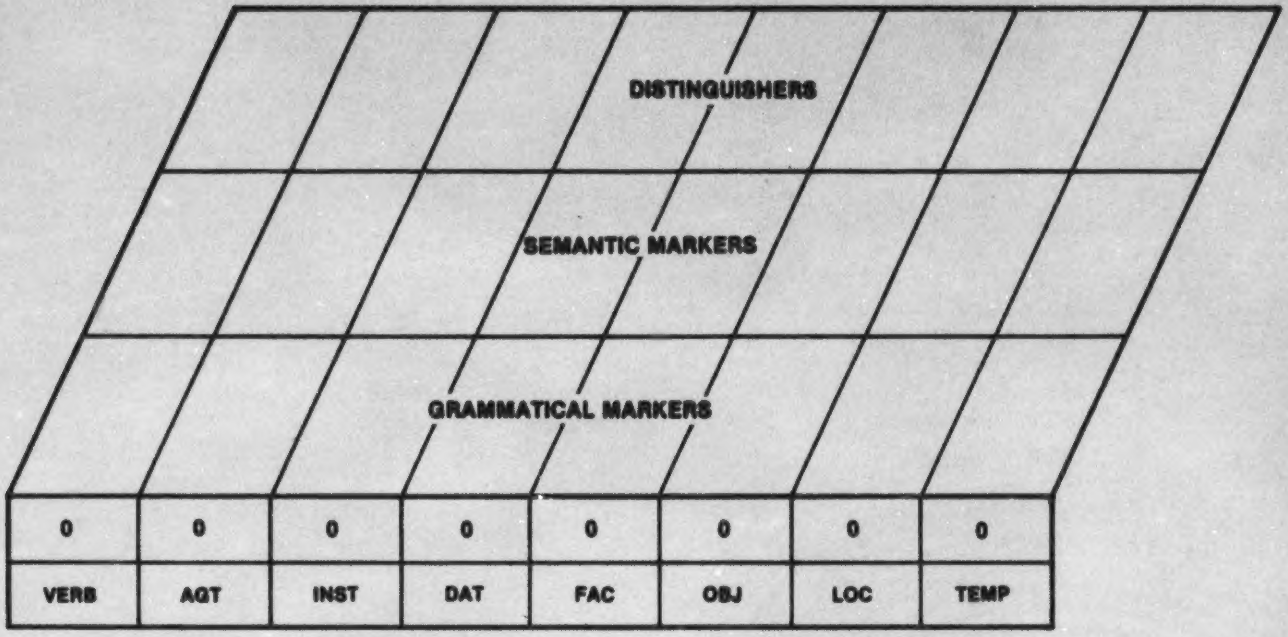

Figure 7 Three Dimensional Model

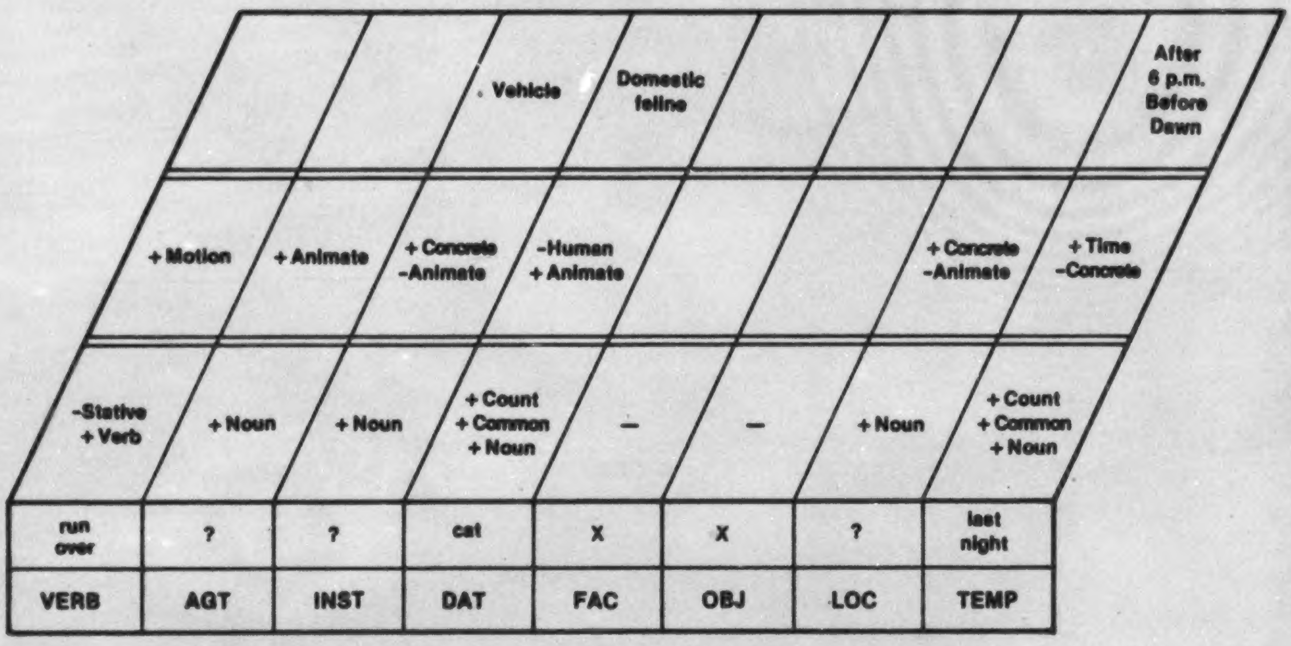

Figure 8 Model Showing Lexical Features for Verb and Case Elements for Sentence 1

Notice that while X elements are entirely empty, ? elements are not. Certain grammatical and semantic features are understood through the definition of particular cases. All case elements must be (+ Noun). Agentive must be (+ Animate). Locative must be (- Animate) and (+ Concrete).*

The second source of filled cells in ? case elements are what have been called "side effects" (Friedman & Bredt, 1968) or "transfer features" (Weinreich, 1966). This concept is related to Chomsky's (1965) discussion of selection features and to Katz and Fodor's (1964) discussion of semantic disambiguation in sentences and to Kintsch's (1972) proposal that the basic lexical elements are propositions. The idea is that when a verb element is filled both markers and distinguishers in case elements for the row are supplied. There is a strong inference, for example, that the Instrumental for run over is a vehicle. (Possibly a mob ran over the cat--but here mob is Agentive and there is no Instrumental.)

When The Subject has read Sentence 2 he fills in the elements of the second and third rows of the array. He encounters a noun in the second row (car) which has many features matching the missing Instrumental in row 1; he tentatively assigns that noun to the sought after Instrumental element. Likewise the subject is seeking an Agentive for run over and finds a noun in the second row (Jones) with many features matching the missing Agentive. He tentatively assigns Jones to the sought after Agentive.**

In Sentences 4 and 5, on the other hand, there is some overlap before the missing Agentive for 4 and the noun Mark in 5. But the overlap has not reached some "critical mass" wherein the ? Agentive cell is tentatively assigned the value Mark. There may be, in fact, a feature of know such that the subject of know may not be the subject of a sentential complement of know. That is, in Mark knew someone killed a cat, Mark may not equal someone.

In summary, in the proposed model the subject assigns ? to case elements that are not specifically given values in the discourse. He does this through his knowledge of case frames for verbs. Some markers or ? elements are supplied by The Subject's knowledge of case definitions. Some markers and distinguishers are supplied by "side effects" of the meaning of the verb in the row. (Cases can supply markers and distinguishers for other cases as well. If the Agentive of run over were a child one might assume that the vehicle (instrumental) was not motorized.) The Subject then assigns nouns from case elements assigned in other sentences to case elements which have not been filled in a given sentence. He does this by searching for overlap between semantic information on a given noun and semantic information known about the missing noun. If there is no contraindication that the inference is correct--as discussed relative to the verb know in the last paragraph--the missing element is assigned a value.

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*The reader may argue that in You know in your heart he is right, Locative may be (- Concrete). This kind of dispute arises from the fact that the case categories used here are not sufficient. Several authors (Fredriksen, 1975, for example) have greatly extended and refined the gross categories proposed here. The author hopes that the question of whether the model proposed here is cogent and useful be kept separate from the question of what refinements will be necessary to implement the model.

**Note: One can think of the relationships that nouns enter into with verbs and other nouns in sentences as a particular kind of distinguisher. The meaning of Jones in this discourse is both that he is drunk and that he is driving a car. A discussion of Mower (1954) would be relevant here.

Implications of the Three Dimensional Model as a Model of the Reading Process

Information theorists have found English to be about 50% redundant (Shannon & Weaver, 1949). One example of this redundancy is as follows: If one presents a text one word at a time to a subject (a native speaker of English) and asks the subject to guess what the next word will be after each word is presented, the subject will guess the next word correctly about 50% of the time. More recently, Goodman (1967) has described reading as an "anticipatory process" and has dubbed reading a "psycholinguistic guessing game."

It is my view that the anticipatory process described by Goodman and the redundancy of English described by Shannon & Weaver are the same phenomenon and that this phenomenon is explained in part by the fact that the reader's knowledge of case frames and side effects enable him to anticipate certain kinds of information (case relationships) in the form of words whose meanings are partly known to him (through side effects) before he encounters the actual words in the text.

Testing the Model

Side effects indicating a particular word. Some verbs have highly specific case values. Kintsch asked 27 subjects what information is inferred unambiguously and with complete certainty in the sentences The secretary types and Peter was shot. Eighty percent of the subjects reported that typewriter and gun were inferred from the two sentences.

I propose that the use of definite and indefinite might be used to test the strength of such inferences regarding highly specific verb-associated case values. I hypothesized that the verb type so strongly infers the Instrumental typewriter that if typewriter is mentioned in a clause following a clause with the verb type it will be marked by a definite article (the) rather than the indefinite (a), as if it had been mentioned previously in the discourse. In other words, 6 would be expected while 7 would not.

6. She finished typing and covered the typewriter.
7. She finished typing and covered a typewriter.

On the other hand, sentence 8 is highly unlikely while sentence 9 is expected.

8. She finished typing and took out *the* pencil.
9. She finished typing and took out a pencil.

Side effects indicating one of a small class of words. Some verbs supply so many semantic features of associated case elements that the missing word could be one of only a few words. *Eat*, for example, supplies much information about its associated Objective. The verb *blackmail* demands an Agentive and supplies many features for the Agentive element. According to the model then 10 would be likely and 11 would be highly unlikely.

10. Gladys was blackmailed. *The* culprit showed her no mercy.
11. Gladys was blackmailed. *A* culprit showed her no mercy.

On the other hand, 12 is anomalous but 13 is expected.

12. Gladys was blackmailed. *The* neighbor was in on it.
13. Gladys was blackmailed. *A* neighbor was in on it.

Once again I interpret this as evidence that *culprit* shares so many features with the side effect features for the Agentive of the verb *blackmail* that one acts as if *culprit* has been mentioned before in the discourse and marks it with the definite article.

I have at this moment a bit of evidence to support these hypotheses. I gave nine graduate students the following eight sentences and simply told them to fill the blanks. In parentheses following each sentence is a tabulation of responses. Several of the sentences which have not been discussed conform to the hypotheses but I think there are alternative explanations for the choice of the article. I will revise this and use more subjects before April 4th.

	the	a	
1. After driving to Chicago Dan parked ___ car.	(6)		his (2)
2. She finished typing and took out ___ pencil.	(1)	(3)	her (4)
3. I denied it but ___ rumor persisted.	(9)		
4. Gladys was blackmailed. ___ culprit showed her no mercy.	(7)		that (2)
5. Cecil continued eating although ___ turkey was cold.	(8)		her (1)
6. After driving to Chicago Dan had ___ meal.		(8)	his
7. She finished typing and covered ___ typewriter.	(5)		her (3)
8. Mary was blackmailed. ___ neighbor of her was in on it.	(1)	(5)	that (2)

A second source of evidence comes from a search of previously written discourse (not intended for an experiment) for instances of case values which are inferred across clause boundaries. A brief search revealed that truncated passive sentences often have implicit Agentives from other sentences. The following examples are from published material--but abridged to make the point clearer.

> Literacy is important in democracy. To choose the best candidate voters must understand public problems and policies advanced for dealing with them.

14. Who advances policies? (Candidates (?))

> Parliament did not want to share England's technology with other nations. Laws were passed to forbid taking plans for machines out of the country.

15. Who passed laws? (Parliament (?))

Subjects answering questions 14 and 15 as indicated would be evidence that case values are supplied from nouns in other clauses in terms of matching side effect features of ? elements in a given clause with features of supplied case elements in another clause.

This kind of evidence can be gathered for other than Agentives in truncated passages. The following two examples (again abridged from published materials) demonstrate how the model might explain assigning values to Locatives across clause boundaries.

> The great fish rose his full length from the water and then reentered it. The fisherman's line commenced to race out.

16. Where did the line commence to race out? (Into the water (?))

> Slater came to live in the United States. He set up a spinning machine from memory.

17. Where did Slater set up a spinning machine? (In the United States (?))

Using the concept of case frames one can identify the elements for each verb in a discourse that may possibly be given values. Using the concept of case redundant lexical features and side effects of verbs and nouns in each row in the model, one can identify grammatical, semantic, and distinguishing features of missing case values. Using the highly specific information gained by the relationships between nouns and verbs which are given in discourse (such as interpreting the sentence Jones was drunk as adding a distinguisher noun Jones, [+drunk]) one can test the hypothesis that it is commonality of features of given and missing case values by which inferences are made. Possibly, then, one can begin to manipulate discourse to discover, a) when these inferences are so universally understood to occur that they are better thought of as explicit information than inferences, b) when these inferences become so tenuous as to be nonexistent, and c) what kinds of features and how many features must be shared before the inferences are reliable.

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DISCUSSION OF THE FINN AND ROSENBERG PRESENTATIONS

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I am going to comment from the point of view of two sorts of texts we have been working on in Toronto: the first are from normal speakers in three contexts: narratives, cartoon descriptions and interpretations, and conversational interviews where the topics could be chosen by interviewer or subject, and the second are from schizophrenic speakers who are considered by psychiatrists and lay people to be "thought-disordered," i.e., to produce discourse which is lexically and syntactically adequate, but where the sentences/propositions do not always seem to be tied together. The so-called thought-disordered speakers are excellent testers for theories of discourse because, as I'll indicate below, they do many things right about discourse. . .and yet occasionally seem inappropriate to the normal listener. So a theory of discourse needs to be able to specify what they are not doing--a difficult task as I'll try to indicate.

I. CASE FRAMES FOR VERBS

It is exciting to see the notion of case relationships between sentences being developed as a means of mapping out possible discourse networks or structures. In our own work, we have neglected the power of the verb to direct the discourse theme, and consequently, have often been at a loss to explain why several sentences with the same actor do not make a coherent piece of discourse. In addition, the notion of both authors of case frames setting up active processes to make sense of new information is a valuable one. It suggests to me that empty (Finn's ? and Rosenberg's Default) slots may be problematic for the listener as they accumulate, because the listener is searching for fillers while attempting to process rapidly incoming information.

II. IS CASE GRAMMAR ENOUGH?

I want to raise this question in two perspectives. The first is a very broad perspective. It is a necessary one for us to keep in view, but has little immediate thrust for the two papers here. The second is more narrow and may be a more useful one.

A. As Halliday has shown us over and over again, we North Americans act as if discourse were something that happened in books, or at least in highly structured forms like narratives. It is fair for us to try to overlook this in our early attempts to say what discourse is, but it is probably going to get us into trouble if we forget that discourse links are routinely done, in every spoken sentence, with stress and intonation patterns, with early versus late placement in sentences, with pragmatic form-pairs (e.g., Dore, 1977). And just as important, it is essential that we be aware of the limitations of the contexts we choose to study. Our work in Toronto has shown us repeatedly that we can scarcely generalize across contexts without doing violence to the fine grain of the data.

B. The narrow perspective is this: Can one account for discourse structure adequately on the basis of slots for the verb? (This question does not do justice to Rosenberg's paper, but it is relevant.) I don't think a focus on verbs is going to be sufficient because this means a neglect of noun phrases and their links to each other. I'll cite some data to try to indicate the extent to which this seems important.

1. Using Halliday and Hasan's (1977) measures of cohesion in discourse, we find that normal speakers in interviews use about 2.1 ties per independent clause and thought-disordered speakers used about 1.9 ties. I think this is about double the values Rosenberg reports. The values we find for narratives are about double our interview figures.

   Now, 60% of the ties we find in interviews are due entirely to links between noun phrases, and the proportion for narratives is 80%. This suggests, at least, that one is missing a lot in neglecting the cohesive power of such links.

2. We divided all noun phrases into those which presented new information, and those which presupposed information. The latter could presuppose information from the general culture or from the specific utterance context. Noun phrases which presupposed the utterance context (definite noun phrases) were very common--constituting from about 60% to 80% of all noun phrases, depending on the context. Each such item which makes a presupposition to the utterance context surely constitutes an important link--a discourse link for us because these were measured between independent clauses.

3. We asked 10 lay judges to assess the coherence of interview segments, and found that we could account for about 40% of their decisions on the basis of where the speaker located referents for definite noun phrases.

4. Perhaps the most persuasive evidence indicating the limitations of case grammar alone are some examples from our thought-disordered speakers. Here are two. The first seems to be a good example of the speaker changing actors without warning. The second, an example of simple repetition of the verb, giving what Rosenberg would perhaps term Augmented Expectations, again and again and again.

    (Retelling a narrative): well the farmer was going across the river with a donkey/and he went across/and he got in the middle/and the donkey decided to sit down in the cold water/ so he did/and then the salt it went in the water/and dissolved/and so he lost all his salt/ so the next time he took some sponges/and the donkey sat down again/and he got up/and the sponges make the load on the donkey's back very heavy/so he thought that would train the donkey not to sit down again in the water if he had to carry that very far/

    (Excerpt from an interview): okay what else do you want me to talk about?/I like peaches/I like pears/I like plums/I like apples/I like I like vegetables/but I like I like things that are sweet/I like steak/and I like stuff like that/ but I like sweet things sort of sweet-tasting/ I like beaver/I like bear/I like I never tried muskrat/I like I like milk/and I like I like fruit/

I am grateful for having had a chance to comment briefly on these two creative papers. I hope that we may all continue our dialogues by mail.

DISCUSSION OF THE FINN PRESENTATION

Charles A. Perfetti
University of Pittsburgh

Finn's presentation strikes me as an interesting proposal, in several respects. For example, the assumption that definite references in one sentence are linked to implicit arguments of a previous sentence is nicely demonstrated. However, I suppose it is most useful to focus on just a single issue, that of how to decide some broad issues of theory development.

Describing comprehension of connected sentences is a major theoretical objective for psycholinguistics and, of course, entails many problems in developing a theoretical framework. Consider, for example, the division of theoretical labor into structure and process. Understanding discourse is a matter of representing knowledge and of encoding language with respect to the knowledge structures. Finn's proposal is for a model of discourse comprehension that emphasizes the structure of knowledge, viz. knowledge of semantic roles and syntactic categories associated with words. The question of how a person uses this knowledge, or what in the discourse triggers this knowledge, would remain a problem, as it has for every model of comprehension.

There is another, more problematical, decision in proposing such a model, assuming that its main objective is to account for structures that guide comprehension. The decision is what kind of information to include, and how much of it. Consider Finn's sentence example: (1) A cat was run over last night. Case knowledge tells us that a recipient must be supplied on grammatical grounds and that an agent, a time, a location, and an instrument are present semantically but deletable in English. When the sentence is understood, a person knows what was run over and when, and he knows that he doesn't know how, where or by whom. But he also does not know why and he does not know the consequence. Motivations for actions and their possible consequences are also a part of knowledge and apparently a systematic part.

Cases are roles taken by arguments (nouns) with respect to predicates, and the possible (filled and unfilled) cases are accordingly constrained by the verb. Knowledge of run over, for example, includes the necessary and optional cases. This solution is harder to apply to things like consequences, however. How do we represent the fact that the comprehension of (1) but not (2) saliently includes the consequence of possible fatality?

(2) My toy truck was run over last night.

This consequence information is not a property of run over, but rather a property of something like [run over animate object]. Such information can't be represented in a case-system very easily, although categories can be added indefinitely in the absence of some criterion for the range of semantic distinctions the system is responsible for (as Fillmore[1] later pointed out). This problem also holds for semantic features, another component of the model proposed. Bollinger[2] observed that whether any sort of semantic information is included as a semantic marker or a semantic distinguisher, or not included at all is wholly a question of what semantic distinctions are important. In the present example, this has to do with how to represent information rich enough to distinguish car from truck but not coupe from sedan. The potential range of useful information is constrained only by individual experience.

All of this is to note a problem of selecting a framework, not to say that the case plus feature approach is not useful to try. Alternative conceptions seem to gain advantage in being more comprehensive and allowing non-language knowledge to mix with language knowledge. For example, viewing comprehension as the use of macrostructures, schemata, frames, and scripts has these advantages. Disadvantages of these systems are not clear to me, although the proliferation of like-meaning terms may suggest some problems. These systems would include case information in semantic networks that constitute part of the knowledge representation. In addition, procedures are included for generating missing details when necessary as well as for setting up expectancies for missing information of the sort Finn discussed.

I don't believe any proposals solve the problem of how systematic information from one sentence is used in a later sentence and vice versa. There has been more emphasis, appropriately, on the representation of knowledge than its use in a sentence-by-sentence fashion. There is, actually, a resemblance between the proposals that predictable components of schematic information are filled in by the comprehender (as suggested by Minsky, van Dijk, Greeno, and others[3]) and the proposal of Finn that comprehension is a matter of assigning values to case variables. Thus there is agreement that much information is implicit and is filled by reference to message constraints somehow represented in comprehension. The issue is how much of what kind of knowledge to represent.

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[1] Some problems for case grammar. Working papers in linguistics, No. 10, Ohio State University, 1971.

[2] The atomization of meaning. Language, 1965, 41, 553-573.

[3] For example, M. Minsky. A framework for representing knowledge. In P. Winston (Ed.), The psychology of computer vision. McGraw-Hill, 1975.

DISCUSSION OF THE FINN PRESENTATION

Philip H. Cook
San Jose State University

My initial reactions to this paper are two:

(1) I'd prefer seeing examples (of paragraph length) from academic prose--the language of any academic discipline (engineering, physics, chemistry, nursing, sociology, even linguistics)--before passing judgment as to the success of this model as a descriptive tool.

(2) Several of the sentences depend on context or environment to be judged as to their "anomalousness."

There can be no question that there are a number of "connectives" that serve to tie together a sequence of sentences into a discourse text. Among these ties are such explicit connectives as (co)reference; repetition; conjunction; ellipsis; sentence initial adverbials of time, place, etc.; and implicit connectives such as the placement of elements within intra-sentential information structures of theme and rheme. Fillmore's (semantic) case relations offer one more intriguing means of understanding inter-sentential relationships.

It seems as if the principal advance that Finn is making is a means of understanding a part of the process of reading, especially the points he offers as evidence for the validity of his model when the reader faces passages with ellipsis (the truncated agentives and locatives across clause boundaries). Analysis of this sort should prove of particular value to ESL teachers.

Despite the apparent value of Finn's model, I'm skeptical of any model that purports to describe discourse when the bulk of the evidence is from data confected to fit the purpose. And I'm even more skeptical when the data fails to exceed two or three short sentences. Has anything of the sort described in the paper been done on material from academic texts? I'm especially interested in academic texts because these are the materials students actually have to understand if they are to succeed in schools. And I'd consider the model of practical--as opposed to heuristic--value if it holds up over a text of several paragraphs.

As for some of the examples, I have no difficulty obtaining 12, which is identified as anomalous:

12. Gladys was blackmailed. The neighbor was in on it.

This is anomalous for me only if Gladys has more than one neighbor or if there is no previous sentence that identifies a specific neighbor, as in (a).

(a) Gladys has a neighbor whose hobby is photography.

In other words, the definite article in 12 must serve as an anaphora to a specifiable neighbor. Given the circumstances of Gladys' having only one neighbor, or many neighbors but one with a specifiable restricting quality, 13 becomes anomalous, even though it is identified as "expected."

In 6 and 7, I believe the anomaly results from the verb of the second predicate. I have no trouble, for example, in obtaining:

(b) She finished typing and asked for a typewriter.
bought
demanded
requested
.
.
.

The set of (b) is certainly allowable if the second predicate contains an adjective like, for example, new.

If, one the other hand, the first predicate has as its surface structure object the letter, etc., then the choice of article seems dependent upon presuppositions other than those having to do with the verb type:

(c) 1. She finished typing the letter and took out the garbage
the laundry
the pencil to make corrections
.
.
.

In short, I'd suggest using (1) longer texts and (2) texts from authentic sources, especially from published introductory texts for a given academic discipline for data. This will lend credibility to the results and prove the findings more applicable to both teachers and students.

DISCUSSION OF THE FINN PRESENTATION

Georgia M. Green
University of Illinois

Question

One of the reasons that Case Grammar has lost favor among linguists (and been all but abandoned by Fillmore) is that the number of cases was continually having to be expanded (you make oblique reference to this in your footnote on page 40). Do you think that Case Grammar is worth using as a model for comprehension if it turns out that, say 18 or 20 cases are required for syntactic or semantic or pragmatic reasons?

Comments

1. The examples presented are surely illustrative of some kinds of inferences that are made in comprehending connected discourse. But there is a lot more to sentence meaning than just case roles and Katzian features. To see this, consider the fact that according to the scheme presented here, a hearer would make the same inferences about the agent and instrument implied by sentence 1 (A cat was run over last night) if the following sentence was Jones was out of town and was not driving his car at all, as he would when the following sentence was sentence 2 (Jones was drunk and driving down Main Street). Even if a relatively simple negation function can be constructed to deal with this case, can sequences like the following be dealt with appropriately?

I. (i) A cat was run over just outside Peoria last night.
(ii) Jones was drunk and driving on I-74 at the time.

II. (i) A cat was run over just outside Peoria last night.
(ii) Jones was drunk and driving down I-57 at the time.

A rational speaker who uttered either of these sequences would presumably have done so with the intention that the content of the second sentence be understood as relevant to what was communicated by the first sentence. But it is only real world knowledge that allows a hearer to infer that the speaker is suggesting in (I) that it may well have been Jones who perpetrated this deed, and in (II) trying to say that Jones couldn't have been the one.

2. There are a couple of problems with the analysis presented here which strike me as inherent in any attempt to implement the theory of Case Grammar as a model of comprehension. For example, no provision is made here for case roles that might or might not be knowable. Specifically, on page 39, the AGT slot for run over is given a value '?', indicating 'knowable but unknown,' and a value '+Animate,' since agents are necessarily animate. But cats can be run over by runaway, driverless vehicles, as in Felix was run over by a runaway tractor, when it slipped

into gear as the driver was dismounting. I do not think we would want to say that either the driver, or the tractor (personified) was an agent here. But that leaves us with run over with an 'X' in the AGT slot; there is no agent. Does this mean there are two verbs run over, one Agentive, one not? Or are there three verbs run over, one Agentive and Instrumental, one just Instrumental (the tractor case), and one just Agentive (the mob case cited on p. 40)? This is not an isolated problem, restricted to run over, so it is a serious defect in the theory if the answer is 'yes,' as a system with such a large and arbitrarily constrained lexicon would seem to impose an enormous burden on the language learner.

3. The comprehension strategy hinted at on the bottom of page 7*--make all inferences not contraindicated--is an attractive and powerful one, but the framework outlined here is far too restrictive to utilize its full potential. A number of American linguists have abandoned not only the attempts to "atomize" meaning of Katz and Fodor, but also later ones framed within the theory of Generative Semantics (e.g., Nunberg & Pan, 1975; Morgan, in press) and have been exploring pragmatic theories of discourse comprehension based on Grice's (1975) work on implicature. These theories involve making as many inferences as possible about the speaker's intentions in uttering a certain form in a certain situation, and they hold great promise of solving a number of descriptive and theoretical problems.

On the other hand, it would be wrong to assume that people make all possible inferences not contraindicated by what they "know." Sentences are not "found objects," interpreted independently of the hearer's beliefs about the speaker and the speaker's probable purpose in uttering the sentence. (There is now an enormous linguistic literature on this. See Grice (1975) and Morgan (1977) for an introduction.) Rather, it appears that the inferences the hearer makes are those that he infers he was intended to make. I do not see how an adequate theory of discourse comprehension can fail to take account of at least those matters of speaker intention and hearer estimate of speaker intention that Grice mentions.

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*Editor's Note: See the bottom of the first paragraph on p.41.

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DISCUSSION OF THE FINN PRESENTATION

Alexander Wessitsh

My first point is this: Harris (1952a, b) found transformational relationships between some sentences in short discourses. Fillmore (1971) maintained that each sentence has one set of cases. Thus, for any two sentences, there could be two entirely different sets of cases. However, Chomsky (1965) also maintained that transformations do not change meaning and hence case relationships. Therefore, any two sentences related by transformations must have the same set of cases. Thus, some intersentence case relations are to be attributed to transformational rules, rules that are already devised.

My second point is this: Deese (1970) and Bolinger (1965) criticized lexical features as being theoretically unwieldy. In particular, Deese (1970) pointed out that there is no way in principle to limit the number of features. Bolinger (1965) had 12 criticisms. Among them, one criticism was that different feature systems may apply to the same lexical items and another was that a lexical item often is best defined by the overlap in meaning between synonyms and not by features. These are also theoretical problems for this model.

Further, the model includes three means for discovering missing case elements, the ? entries. First is a check to see if there are any case frames with missing elements. These are set to ?. Second is a scanning of other parts of the discourse for explicitly specified entries which fit the ? slot. Third is a derivation process based on features. These three means are presumably short term or processing memory tasks. Given Deese's (1970) and Bolinger's (1965) arguments, STM would have a task beyond its capabilities to process information.

There is no doubt that there are physical and syntactic cues which can be processed psychologically. Stress and pitch as well as word order (a cue for case in English) are examples. The difference between cues and features is that cues are empirical while features are abstract. But assume that semantic features were empirical, that is, semantic cues, and that all cues were combined, then the whole mass would have a character different from a listing of features. In particular, it would have the characteristics of the interference patterns which Pribram (1969) proposed for brain functions. These correlative patterns summarize masses of sensory data into paradigm patterns thus reducing processing load. These patterns are conceptual, i.e., they apply to a number of similar but actually different stimuli. Similarly, linguistic cues conceived of as conceptual patterns leave open the possibility of metaphor, simile, and other creative uses of language whereas, as Bolinger (1965) objected, features do not leave these options.

My third point is this: Case makes reference to the world whereas features codify sense relations which are abstract.

There are obvious relations between the production of case and events in the world. This is in contrast to the productions of two other parts of language which modify a message to conform to current expectations of the recipient and modify it to produce a coherent "argument." The latter two parts can be labeled 'interpersonal' and 'discoursal.' Each of these three parts contributes to the anticipations a recipient develops for a message he is trying to comprehend. However, the latter two parts of language are transitory and immediate devices whereas case, because it incorporates world knowledge, is an enduring one.

This enduring quality of course could be based on sense relations (features). However, this would take case out of the psychological into the logical. One would logically expect that each case would be complete, consistent, and independent. In fact, one of the obstacles to case grammar is that case, like world knowledge, appears to be partial, inconsistent, and redundant. Winograd (1971) offers a model to accommodate these as psychologically rather than logically enduring characteristics.

In short, because case is referential, it is unlikely that features are appropriate to it.

My fourth point is this: If cues could be tabulated in matrix form as suggested in the paper, perhaps some matrix algebra of linguistic and discoursal text could be devised.

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RESPONSE TO DISCUSSION

Steven Rosenberg

I am glad to see other researchers are looking at discourse structure in the real world, and I would like to reply to some of Prof. Rochester's comments.

I. In our system, forward expectations on empty slots do not require the listener to spend time searching for that slot filler. The empty slot defines a semantic type which any filler is an instance of. In an organized semantic system such as ours, triggers can be placed in the appropriate location for that semantic type. New instances of that type cause these triggers to fire, alerting the listener. The listener, however, does not need to be actively searching for these slot fillers.

II.A. A good point. I think we will have to make use of the other forms of information available in sentences, particularly spoken sentences.

B. In our model, although we represent sentence meanings in terms of frames organized around verbs, we do reference on the slots of those frames. Values of these slots are themselves frames which have slots and values. For instance noun phrases are encoded in this fashion. Thus we also do noun phrase reference.

B.1. The values I reported were for intersentence links only. Since The New York Times uses fairly complicated sentences, basing my measure on independent clauses rather than sentences might have resulted in higher mean values.

B.2. Dr. Rochester is quite right in emphasizing the importance of conceptual knowledge in understanding discourse. One goal of the current work was to see how far we could get with reference processes which did not require such knowledge. The task of building computational models which use detailed semantic knowledge of the context in understanding discourse (e.g., Winograd, 1972), is a very difficult task.

RESPONSE TO DISCUSSION

Patrick J. Finn

It seems to me that these fives responses each concede that the idea presented in the paper is alright as far as it goes, but:

Cook adds--until you've demonstrated that you can make this work on the kind of written discourse one finds in school books, I'm reserving judgment.

And Rochester adds--case grammar is an interesting approach, but other considerations will have to be taken into account if the model is to be worked out.

To Cook's and Rochester's qualifications I would answer, yes. I believe the model can be made to apply to texts that were not invented to demonstrate the model and that I believe other considerations such as Halliday and Hasan's work on cohesion would enhance the model considerably.

Perfetti, Green, and Wessitsch suggest that any proposal based on Fillmore's case grammar and Katz-Fodor's system of semantic markers is in serious trouble because the proposals of Fillmore and Katz-Fodor are in serious trouble.

General Responses

I am aware that the demise of case grammar has been proclaimed in many quarters. The contention is that if you try to make case grammar work in real language, it is going to get very complicated very fast. The implication is that some alternative scheme when applied to real language will remain uncomplicated. The contention is obviously true. The implication is probably not true--it certainly has not been demonstrated.

Secondly, I suppose no one has recently made reference to a straight-forward Fillmore, 1968, "Case for Case" type case grammar as I have done in this paper. But the idea of case relationships is still very current among very respectable people dealing with discourse analysis (e.g., Frederiksen, 1975; Meyer, 1975; and Minsky, 1975). As I state in my footnote on page 40, this system has been refined and elaborated upon by others. Perhaps I was at fault for not explicating the objections that have been raised to Fillmore 1968 and the elaborations that have been made on the concept.

I suppose, too, that I should have made it clear that in using Katz-Fodor's system of semantic markers/distinguishers, that I was not adopting two major theses of the 1964 paper where this scheme was introduced. The theses are: 1) that there is a difference between linguistic knowledge and knowledge of the world, and that knowledge of the world may not be part of a theory of semantics, and 2) that one disambiguates a sentence by becoming cognizant at some level of all possible meanings of all the words in the sentence and lets these meanings operate on one another, cancelling each other out, until there was only one meaning left.

I think it is quite clear in my paper that I do not propose that the reader consider every possible meaning of every word; I propose instead that he is constantly searching for words with particular sets of markers. The reader operates on the hypothesis that when a word is encountered with two or more sets of features, the set which contains features he is seeking is the correct set. He never considers other sets. Another way of saying this is that the reader brings features to words and looks for matches, rather than encountering a word, finding all possible features, and finally selecting that set which is not anomalous in the particular context.

Regarding Katz-Fodor's dictum that knowledge of the real world is inadmissable in a semantic theory, I have for so long found that to be untenable and have come to think, following a loose interpretation of Bolinger (1965), that distinguishers are in fact partly semantic features that have not been formalized into dichotamous markers and partly knowledge of the real world that does not lend itself to dichotamous codification. This has been so much part of my thinking that I not only failed to disavow that portion of the 1964 paper, but I was at first puzzled by comments that my model did not permit reference to knowledge of the real world.

I find the Katz-Fodor marker/distinguisher scheme useful. I have found it to be very easily understood and appealing to one's experience with the notion of "meaning." Bolinger (1965) points out that it has much in common with the way words are defined in dictionaries. Under certain circumstances, there may be advantages to having entries in a lexicon take a different form, for example, a list of propositions connected through the operations of conjunction and disjunction (as proposed by Kintsch (1972)).

It would have been wise for me to have specified that the marker/distinguisher notation was being used for expedience and that I did not wish to impute to my model the Katz-Fodor attitude toward knowledge of the real world. However, when one's purpose is to put forth a theory, I believe he ought to state it in terms that are as simple and clear as possible. I find the Katz-Fodor scheme serves very well for discussion of that aspect of the model that I wished to address in this paper--how one assigns case relationships between sentences.

Specific Responses

Perfetti's discussion of a "case" like Consequence for a verb like run over. Case frames can be filled by sentences as well as by nouns. "Consequences" could have a feature destruction or injury.

As I suggested, Nouns can supply markers for other nouns through transfer features. If the thing run over is animate the marker injury replaces the more general one of destruction.

Perfetti's discussion of sentence by sentence interpretation. I presume one is not to take Perfetti's comment "There has been more emphasis, appropriately, on the representation of knowledge than its use in a sentence-by-sentence fashion" to mean that inquiry into the problem of how information stated in one sentence is used in other sentences is inappropriate. The fact that the major effort in discourse analysis is presently focused on the representation of knowledge does not mean that all the problems with analysis at the sentential level have been solved.

Minsky (1975) notes that language is processed by a system of frames, but he points out that we don't know where the frames come from. If people start working on this question (where frames come from) it should not imply that the questions of how frames operate have been answered or should be abandoned. Indeed, continued work on frames may help us to understand where they come from. It is likewise true that continued work on sentence-by-sentence comprehension may help us to get an operational understanding of the structure of knowledge.

Taking Green's Numbered Paragraphs:

1. My failure to disavow the Katz-Fodor decision to disallow knowledge of the real world understandably led Green to comment on the problems which follow from that decision. However, I would like to take advantage of these comments to make my position clear on what kind of knowledge is relevant to the model.

Green states that the sentence Jones was out of town and not driving his car at all would lead the reader to make the same inferences about agent and instrument as if the sentence were Jones was drunk and driving down Main Street. I suggest in the paper that when words enter into sentences they take on a particular kind of distinguisher. Part of the meaning of Jones is that he was drunk and driving a car. Jones has many features in common with the missing agent of Sentence 1. When part of the meaning of Jones is that he was not driving and was not at the scene, not only are the decisive common features taken away, but contraindications are introduced.

Regarding Green's example sentence pairs I and II, of course one would have to know whether I-74 or I-57 passed Peoria in order to know whether Jones was the probable Agentive of run over. Knowing what drunkenness is and how it may be relevant to driving and runover cats is as much real world knowledge as what highway passes close to Peoria.

2. The model presented in this paper explicitly states that case values are assigned tentatively. After Sentence 1, the reader is alert to the possibility that the unstated agent will be named. It

may turn out that the agent is never named, or that indeed there is no agent as in the case of the run away tractor. It does not follow that the language learner must learn three isolated meanings of run over. It follows much more reasonably that the language learner must learn one meaning of run over and the case relations that are possible for that verb.

Frankly, I am mystified by the fact that Green stated that I hinted at the strategy of making all inferences that are not contraindicated. What this paper is all about is the criteria upon which the reader decides what inferences are possible and what constitutes a contraindication.

Summary

Fillmore's grammar and Katz and Fodor's semantic scheme provide a useful descriptive framework for the hypothesis presented in this paper--that it is the commonality of features on case values that are given case values that are missing that enables one to make inferences across sentence boundaries. I think this is a useful and researchable hypothesis. The questions of whether there are more current proposals for the nature of lexical entries or whether there are discourse theories that are more useful in understanding other language phenomena, such as understanding face to face spoken discourse or describing the structure of knowledge, do not make the hypothesis presented in my paper any less useful or researchable.

DISCUSSION OF FINN'S RESPONSE:

Georgia M. Green

Perhaps we are referring to different versions of this paper. When I read "If there is no contraindication that the inference is correct--as discussed relative to the verb know in the last paragraph--the missing element is assigned a value", I took it as referring only to inferences about case roles, not to all possible inferences. There is still more to the meaning of sentences in context than just case roles and Katz-Fodor features, and what can be inferred from expectations about them. Much of it, we agree, involves inferences about the real world, and I will add, about the speaker's use of particular linguistic forms. We seem to disagree on whether it is going to be useful, or even possible, to describe all inference-derived information about the meaning of a text as Katz-Fodor distinguishers on particular lexical items.

In particular, it strikes me as problematical, at the very least, to say that part of the meaning of the word _Jones_, is "that he (who?) was drunk." Even if what Finn means is that part of the meaning of the word _Jones_ is that the person referred to by that name was drunk, it seems to me that he (Finn) has lost sight of the crucial and well-established distinction (cf. Grice 1957) between what a sentence (or a word) means (sentence meaning, word meaning, literal meaning), and what a speaker means in uttering it (speaker's meaning, conveyed meaning).

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DISCOURSE PROCESSES IN ELEMENTARY SCHOOL CHILDREN

William J. Russell and David Snow,
SWRL Educational Research and Development

This paper reports a study done at SWRL where we are investigating the school age child language of English and Spanish speaking pupils. In our efforts to characterize the development of oral and written language skills in elementary school age children, we have become particularly interested in connected discourse because discourse-making skills continue to develop after most of the basic syntax is mastered. In our view two major features of effective discourse in need of further definition are economy and unity. For this study we focused on co-referential pronominalization and anaphoric deletion because they have clearly observable surface forms and because they appear to contribute to the economy and unity of discourse.

Previous linguistic-based research into school age language development has concentrated mostly on vocabulary, morphology or sentence level syntax, or has been at too broad a level of generality to allow for the characterization of specific discourse-making skills (e.g., see the school age child language literature summary by Palermo & Molfese, 1972). One of the principal findings of several discourse level investigations, for instance, is that the length of the particular communication unit used in the investigation increases with age (Loban, 1963; Hunt, 1965; O'Donnell, Griffin, & Norris, 1967; Conway, 1971). These studies were designed to collect "typical" and "natural" production in relatively unconstrained situations such as showing a silent movie and asking for a narrative report of it, and therefore did not lend themselves to the intensive investigation of specific phenomena. Among the more specific findings of these studies an apparent paradox emerges: older children learn not only to use "more language" (variety of words, longer communication units), but also less--that is they also acquire skill in syntactic strategies that involve judicious abbreviation or deletion of redundant material. O'Donnell et al. (op. cit., p. 90), for instance, report the more frequent occurrence in older elementary school children of several syntactic patterns that involve transformational deletion. Loban (1966, pp. 24-26) reports a dramatic increase between 6th and 8th grade of what he terms "confusing use of pronouns." This observation seems to be best interpreted as indicating that younger children in his study did not use coreferential pronouns nearly as often as older children in the communication situation he set up.

For preschool children the production of some types pronominalization and deletion has already been shown to increase with age. Slobin (1973) observed that when children first acquire full forms they use them in preference to available contractions or deletions. Thieman (1975) tested Slobin's generalization for a variety of deletable and pronominalizable forms in delayed cued recall tasks and found that the youngest child in his study, age 3 years 8 months, showed a marked tendency to supply full forms in recalling sentences presented in abbreviated form (with optional deletions and pro forms).

It seems clear then that children make increasing use of certain strategies for economy in discourse with increasing age, although details for oral production by school age children are not clear. Some of these strategies for economy also appear to contribute unity to the discourse because they have the effect of making various parts of the discourse interdependent.

The contribution of coreferential pronominalization to the unity of discourse gains support from a study (Lesgold, 1972) in which pairs of otherwise unrelated coordinate clauses were presented, both with and without a coreferential pronoun, to subjects who were to later recall as much material as possible from the two clauses when cued with a probe word from one of the clauses. In the case where no coreferential pronoun was present in the stimulus, recall was significantly more restricted to the clause from which the probe word was taken. With coreferential pronominalization the two clauses acted more like a single unit in memory.

If coreferential pronouns and other anaphoric strategies are included in the discourse unifying skills acquired during elementary school, they should appear more frequently in the oral language production of older as compared to younger elementary school age children. The present study tests this hypothesis for certain of these phenomena in specific grammatical contexts. We hoped not only to confirm the increasing use with age of certain anaphoric phenomena but also to learn more about particular conditions for their use.

We chose phenomena for this study that had equivalents in Spanish and English, since we had been working with children who were native speakers of both of these languages and since similar observations for both languages would be compelling evidence for very general behavior.

Subjects and Methods

We conducted individual, tape-recorded interviews of forty-two native Spanish speaking pupils distributed across grades K-6, ten Anglo native English speakers in the first grade, and seven anglo native English speakers in the fifth grade. All pupils were from the same public school in a lower socio-economic section of the greater Los Angeles area. Three elicitation situations were set up, corresponding to three grammatical contexts for target responses. Each child produced between 6 and 12 target responses in each of the three situations.

The first elicitation situation was dramatized with the aid of hand puppets and the child was asked to tell what happened. Target responses for this elicitation situation were pairs of clauses that included an option for pronominalizing the second mention of an object noun phrase. Examples of this response type are given in 1 and 2 below. The relevant options are underlined. Starred options were considered to be potential responses even though they result in ungrammatical utterances.

1. Anita gave the pen to Bill and Bill gave the pen/it to you.

   Anita le dió la pluma a Guillermo y Guillermo te dió la pluma a tí.
   te la dió a tí.

2. (For English speakers only) Anita gave Bill the pen and Bill gave you the pen/*it.

The second elicitation situation was also dramatized with the aid of hand puppets and again pupils were asked to tell what happened. In this case target responses contained the option to pronominalize a noun phrase which was repeated in a different case frame. Example target response types for this elicitation are 3-5 below.

3. Anita gave the pen to Bill and Bill/he gave it to you.

   Anita le dió la pluma a Guillermo y Guillermo/él te la dió a tí.

4. Bill combed Anita and Anita/she combed me.

   Guillermo le peinó a Anita y Anita/ella me peinó a mí.

5. (For English speakers only) Bill combed Anita's hair and Anita/she combed mine.

The third and last elicitation situation targeted responses with grammatically obligatory deletion of a coreferential noun phrase in an embedded relative clause. We had previously noted that some kindergarteners failed to perform this deletion even though the result was ungrammatical. This occurred particularly in more difficult relative clauses formed by deleting a noun phrase other than the subject of the embedded sentence. We elicited relative clauses with deleted object noun phrases by showing the child a pair of pictures each containing a cat and a dog with the only distinction between the pictures being that the cat in only one of the pictures was the object of an action by the dog. We pointed to the cat in one of the pictures and asked: "Which cat is this?", eliciting affirmative or negative target responses of the form of 6. Again the options of interest to this study are underlined, Ø standing for full deletion.

6. This is the cat that the dog is chasing Ø/*it/*the cat.

   Este es el gato que el perro está persiguiendo Ø.
   lo está persiguiendo.
   está persiguiendo al gato.

RESULTS AND DISCUSSION

First we will briefly summarize the results of the three elicitation tasks. Responses to the repeated object noun phrase elicitation task (examples 1 and 2 above) and responses to the relative clause task (6 above) contained numerous instances of all of the options underlined in examples 1 and 6. There were no instances of the ungrammatical pronominalization option in example 2. Responses to the remaining tasks, which elicited repeated noun phrases with a change of case frame (examples 3, 4, and 5 above), on the other hand, contained almost no pronominalization options at all. In all cases the more abbreviated options were most frequently chosen by older children. Now let us look more closely at the results of each of these three tasks in turn.

In tabulating the results of the first task we considered only instances which contained coreferential pronominalization or full specification of the repeated object noun phrase. In a few trials some of the younger children, especially the kindergarten Spanish speakers, produced responses with neither of these options, but with a referenceless pronoun instead. These responses (in both languages) were of the form of 7 below.

7. Anita gave it to Bill and Bill gave it to you.

Such responses were not communicatively adequate due to the lack of a linguistic or situational referent for "it." In any case, the second clause in this type of response does not provide us with the option of full specification versus pronominalization that we are interested in. Such responses were ignored in tabulating results of the first task.

In this first task kindergarten and first grade Spanish speakers chose the fully specified noun phrase in about 70% of trials while second through sixth grade Spanish speakers performed oppositely, choosing the pronoun in 70% of trials. These results are presented graphically in Figure 1. This difference in mean frequency of pronoun choice for the two grade level groups proved to be significant at below the .001 level.

In this task some English speakers chose a type of response pattern not available to Spanish speakers. English speakers may delete the preposition and place the indirect object before the direct object as shown in example 2. This response pattern does not admit pronominalization of the direct object and none of the children violated this constraint. Mostly older children chose this more abbreviated response option: 49% of fifth grade trials as compared to 13% of first grade trials. These results are consistent with those of Thieman (op. cit.) who found that this abbreviated indirect object first pattern was preferred in recall over the expanded form by all but the youngest child in his study. When we consider only the expanded English responses to this task, which permit pronominalization, fifth graders pronominalized the repeated object noun phrase in 75% of trials and first graders in 49% of trials--very much like the Spanish speaker results.

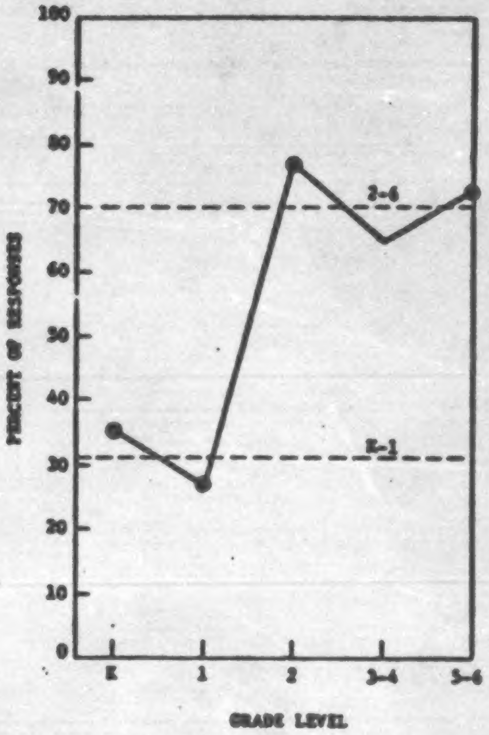

Figure 1. Task 1 results for Spanish-speaking children (see response schema 1, p. 67). Frequency of pronoun usage, by grade-level.

In the second task, where the case frame of the repeated noun phrase was different from its referent noun phrase, the children pronominalized only fifteen times in a combined total of 488 Spanish and English trials. Maratsos (1973) points out that the interpretation of a pronoun spoken with normal stress is governed by a principle of maximum stability of actor roles. In constructions like 8, the pronoun "him" refers to "Harry," the constituent of the first clause which has the same actor role as "him."

8. John hit Harry and then Sarah hit him.

However, if "him" is specially stressed it may refer to the subject in the first clause, "John." The second task of our study was designed to elicit responses which were similar to 8 in that the repeated noun phrase had a different case-frame from its referent (and consequently a different actor role). Maratsos found that children 3 to 5 years old were just learning to interpret specially stressed pronouns of this type. Five year olds had not quite achieved the accuracy of interpretation of these pronouns that was observed in three year olds for unstressed pronouns. It is not surprising, then, that the kindergarten and first grade children of our study simply did not produce pronouns in these special contexts. But one would not have predicted from Maratsos' observations of preschool pronoun comprehension that even older elementary school children would not produce pronouns under these conditions.

The results of this second task cause us to pose a number of additional questions: does this type of coreferential pronominalization also contribute to the unity of discourse in, for example, the way that Lesgold (op. cit.) found that other types of pronominalization do? If so (and we expect that it does), to what extent and in what way does the tendency of elementary school children to avoid it cause their language production to be less effective? At what age do children begin making use of this more difficult type of pronominalization? Does the lack of stress marking in written materials make this type of pronominalization difficult to interpret for elementary school age readers? We are considering these empirical matters in our continuing investigations.

The third task of our study required the child to identify a cat in a picture by attempting to construct a relative clause with the cat as its deleted object. Against strong grammatical constraints in both Spanish and English, most of the younger children occasionally failed to delete this noun phrase, sometimes leaving a pronoun and sometimes a fully specified noun phrase (example 6). The relative clause with a redundant pronoun is, according to native speaker judges, more acceptable in Spanish than it is in English--even correct in some complex cases. However, there was no discernable tendency in our results for the pronoun as compared with the full redundant noun phrase to persist with older speakers of the study. Both of these redundant forms occurred at all ages without a discernable pattern of preference and both diminished in frequency with increasing age. In a straight imitation task redundant forms of both types were observed through fourth grade, and both forms disappeared in fifth and sixth grades. Spanish speaking girls in our sample were more advanced in respect to the relative clause task than boys. Figure 2 displays the Spanish data in considerable detail, showing boys and girls separately and showing the frequency of standard responses increasing with age.

English speakers produced very few redundant responses as compared with Spanish speakers, which is consistent with the observation that such constructions, while ungrammatical in both languages, are more acceptable in Spanish. In a straight imitation task English speakers used redundant forms in less than 1% of trials. In the constructed response task described above for Spanish speakers, eight of the ten first grade English speakers produced ungrammatical redundant forms (again see example 6). One of these eight English speakers constructed eleven such responses in fifteen trials, mostly with fully specified redundant noun phrases. Frequency was very low for the other seven.

More than half of the redundant responses for these seven children were of the following special type, associated with the verb "to comb":

9. The cat that the dog is combing his hair.

A response of this type requires relativization from a possessive case frame, a more difficult construction than is involved in relativization from simple object case structures since the noun-phrase to be relativized is a more complex one. The fact that first graders experience difficulty with these more complex relative clause structures, and that they sometimes use redundant forms in other instances as well, suggests that such responses are part of a developmental sequence that is still partly perceptible in the early school years. Spanish provides a model which encourages the redundancy we have observed, but even without such encouragement there is a language independent tendency, decreasing with age, to employ these over-specified discourse devices when the task of embedding one proposition into another becomes too complex.

In this paper we have presented the results of three tasks eliciting instances of pronominalization and deletion in particular grammatical contexts from elementary school speakers of Spanish and English. We suggested that these and other strategies for economy also function to give unity to the communication by creating dependencies (and consequently a structure) in the discourse. Expecting such strategies generally to be among the discourse-making skills that are refined after children enter school, we hypothesized that the particular coreferential phenomena we elicited would appear more frequently in the speech of older as compared with younger elementary school children. We found that in two of the grammatical contexts this proved to be the case while, in a third, virtually none of the children pronominalized at the ages we sampled. We interpret this latter finding to indicate that a change of case frame is a grammatical condition which strongly inhibits the use of an otherwise economical and unifying discourse strategy--an interpretation that assumes we would find older children or adults using pronominalization in this context. Grammatical context was also found to be an important

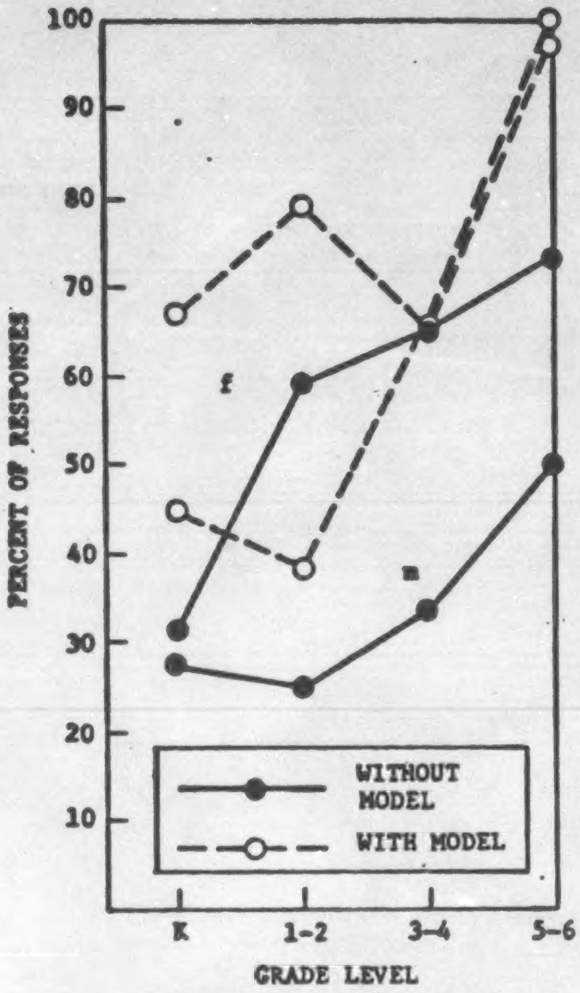

Figure 2. Percent standard Spanish relative clause responses, by grade-level, sex and presence/absence of a model for imitation.

The percent of responses containing a redundantly specified object is the complement of the percent shown; a small number of responses without an identifying embedded clause were ignored in the tabulation.

variable in the case of relativization, where the frequency of expanded response forms was sensitive to the case-frame of the relativized noun-phrase.

In general, our findings suggest a developmental tendency in oral speech production toward increasing economy--with an attendant increase in discourse unity--in both Spanish and English. We observed this tendency across clauses and sentences where the dependencies created by coreferential pronominalization are semantic, and across propositions within a sentence where the dependency is both semantic and syntactic. The range of grammatical contexts in which we observed these age differences, and the similarity of behavior across languages, appears to indicate that the change in discourse strategy over the elementary school years is a very general one, and we expect future studies to reveal other similar developmental patterns in this age range.

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DISCUSSION OF THE RUSSELL AND SNOW PRESENTATION

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This paper is an interesting one because it looks at the production of discourse-related phenomena in school-aged children, rather than, as has more usually been done, on their comprehension. However, even most studies of discourse or passage comprehension have not, until recently, looked specifically at those kinds of discourse features or constructions investigated by Russell and Snow. Those that have, such as Bormuth, Manning, Carr, and Pearson (1970) and Lesgold (1974) have found similar age-related trends, although, as Lesgold cautions, the determination of the difficulty of certain constructions for children at various ages may not be feasible apart from consideration of the discourse context (linguistic and extra-linguistic) in which they occur.

Warden (1976) studied the production of another discourse-related feature--definitization--in children between the ages of 3 and 9, and in adults. He found that the appropriate use of the indefinite article did not occur until about age 9. His tasks, though, may have been simpler than those employed in this study. There does seem, then, to be accumulating evidence that both the comprehension and production of discourse-related linguistic pheonomena continue to develop through the elementary school years. The challenge then becomes to explain this development. Are some of these constructions inherently more difficult than others or do the use and comprehension of them depend on underlying cognitive processes which are changing during the elementary-school years?

Before suggesting how the latter possibility may explain some of the results reported by Russell and Snow, it may be useful to speculate why the authors did not get pronominalization with their second task. Adult data clearly are needed here. My suspicion is that adults would not commonly pronominalize the first noun in the second clause either. In a sentence of the form:

A does X to B, and B does X to C,

there may be some kind of psycholinguistic constraint against pronominalization of the subject of the second clause since the subjects of the two clauses do not match even though, in form, they are parallel constructions. The use of the object noun in the first clause as the agent in the second clause may be constrastive and thus require additional marking. This may be through stress on the pronoun in oral discourse, as the authors suggest, or by adding words to make the contrast explicit: "Bill hit Anita, while she, on the other hand, hit me." Alternatively, the information conveyed in such a sentence may be seen as sequential, in which case, a relative pronoun might be more appropriate: "Bill hit Anita, who (in turn) hit me." In any event, it is important to consider the intention of the message being communicated, and not just "efficiency," in determining what pronoun, if any, might reasonably be employed in any one instance.

An analysis of the first and third tasks investigated by Russell and Snow suggests several cognitive processes which might explain the developmental trends obtained. Clearly, memory constraints may be present, as Lesgold (1974) suggested in regard to comprehension. For the first task, children have to keep the appropriate referent in mind to use it in the second clause. Moreover, use of the pronoun requires the additional operation of transforming the linguistic expression of the referent. Cognitively, it may simply be easier for younger children to express coreference by repetition of the noun with the definite article. The third task, quite apparently, is even more difficult cognitively. Not only does the speaker have to keep the specific referent in mind and transform its expression, but he/she has to place it in a context which identifies it. This requires that the speaker be aware of the needs to the listener so that the speaker will know that further identification of the referent is necessary. Then the speaker has to find an appropriate linguistic form to express this information. An extensive literature now exists which demonstrates that such a sensitivity to listener requirements is a comparatively late developmental accomplishment. Thus, examination of the operations required for use of coreferential pronominalization in various situations may show how to relate Russell and Snow's results to the general cognitive development of school-aged children.

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DISCUSSION OF THE RUSSELL AND SNOW PRESENTATION

Christine Tanz, University of Arizona

I enjoyed reading the Symposium papers, especially yours and David Snow's since I've also done research on the acquisition of anaphoric pronouns and since, like you, I see in this topic an opportunity to begin to investigate the organization of discourse by children.

I would like to make one comment on your interpretation of the results for the first and second eliciting situations. In the first situation the target noun phrase is repeated in the same case frame; in the second in a different case frame. The higher level of pronominalization in the first situation is attributed to this difference However, there is another difference between the two situations (if the examples reported are a reliable guide) which may contribute to the same result and therefore confound it. In the first situation the target noun phrase refers to a unique inanimate object; in the second, it refers to one of two animate participants. There is more potential for confusion in the second situation, and therefore a countervailing force against pronominalization. I wonder what would happen if this difference were eliminated. This could be done by making the object that changes case frames in the second situation a unique inanimate object.

Anita gave the pen to Bill and the pen/it....

(In trying to spell out this example I see the difficulty of creating actions that will compel the desired descriptions.) Alternatively, the target noun phrase in the first situation could refer to one of several animate participants:

Anita gave the pen to Bill and then Anita gave it to you.

I hope this comment will be of some use, and I'm looking forward to seeing the final report.

DISCUSSION OF THE RUSSELL AND SNOW PRESENTATION

Sherry Rochester, University of Toronto

I found this treatment of overspecified referents with younger children very interesting and a welcome approach to age changes. My comments as follows:

1. There is a longer, stronger history to the idea that abbreviation or deletion can be unifying than is suggested in their citations. I think Firbas and the Prague school can be mentioned, and Ruqaiya Hasan (1968: Grammatical cohesion in spoken and written English: Longmans) and most recently: Halliday and Hasan's Cohesion in English (London: Longmans, 1976).

2. I would take issue with the observation that younger subjects produced responses with a "referenceless pronoun" which lacked either linguistic or situational referent. I think this is too narrow an interpretation, for the pronoun "it" in example 7 does refer to the situation. . .if one is not terribly strict about defining what the immediately present situation is. It seems likely that the younger subjects' awareness of the situational context was simply broader than the authors'.

I think this is important, actually. If one insists there is a pronoun without a referent, it suggests that younger subjects don't know very well that pronouns need referents. But if there is a different definition of the context for younger subjects, then their knowledge of this referent rule is not in doubt.

I want to urge that this suggestion be considered in light of our data with schizophrenic speakers. These speakers are often coded as using "Unclear" referents for noun phrases in circumstances rather similar to the ones mentioned in the Russell and Snow paper. And normal speakers are occasionally coded as using such referents as well. But as soon as we allow the just-previous situation to be part of the present situation (in our case, as soon as we allow the original narrative to be part of the present context of situation), then strong differences among our speakers emerge. Normal speakers and schizophrenic speakers who are not in an acutely disordered state never use unclear reference. That is, they never use a pronoun without a referent--though they do use a fair bit of reference to the situation. It is only the disturbed speakers who use "referenceless" pronouns--and they use them very rarely indeed (in about 1% of all of their definite noun phrases).

3. The authors noted that younger speakers use more overspecification than older speakers in some situations. I wonder if this result would depend strongly on the formality of the context. Our work with normal adults shows that the amount of fully-specified reference drops from about

9% of noun phrases in structured contexts (cartoon descriptions and narrative retellings) to about 2% in unstructured interviews. It would be interesting to add the dimension of context and see if sensitivity to context also changes as overspecification drops.

4. I believe the statistical procedures used to obtain significance levels should be described.

5. Bolinger, in his 1977 paper on "Pronouns and Repeated Nouns" makes a wonderfully discursive argument to the effect that, rather than asking the common question of why a noun phrase is pronominalized, one must ask why a referent is fully specified. Russell and Snow, in their original experimental efforts, demonstrate this point very nicely.

RESPONSE TO DISCUSSION

William Russell and David Snow

1. We are grateful to Dr. Rochester for pointing out the long linguistic tradition which has held that abbreviation or deletion can be unifying. Our only citation of work on adult discourse (Lesgold, 1972) was included to suggest a possible psychological mechanism by which economy creates unity.

2. We can readily understand why Rochester finds the term "referenceless pronoun" infelicitous in connection with children's responses such as example 7. We did not intend to imply that for the speaker the pronouns in such responses have no referents. Indeed, it was clear that pronouns used by children in this instance did have unambiguous situational referents. Our observations do suggest that perceptions regarding the adequacy of such referents differ between younger and older children. We were concerned with the communicative adequacy of the response from the listener's point of view. The action of picking up and passing along a pen or pencil was dramatized non-verbally with hand puppets and the child was asked, "What did they do?" Such items in the interview did not immediately follow other items of the same type. The response, "Anita gave it to Bill and Bill gave it to you," appears to assume too much agreement about what is under discussion. It would have been adequate as a response to the question, "What did they do with the pencil?" In any case, such responses did not provide us with data about optional pronominalization of the second mention of a noun phrase and therefore were disregarded.

3. We agree with Rochester that formality of context is an important and interesting variable. Our results show only how these children performed in a certain school-like context.

4. We used the T-test for small sample sizes which appears on pp. 209-210 of Jum C. Nunnally, Introduction to Statistics for Psychology and Education, McGraw Hill, 1975.

5. We think there is merit in Dr. Tanz' suggestion that "pen" might have been more available for pronominalization than were the animate participants of Task 2, for pragmatic reasons that were not considered in our discussion. To properly compare task situations it is necessary to control many task variables.

6. As Dr. Pace points out, a number of investigators have emphasized the importance of the total discourse context to any particular performance result. It has become increasingly clear to us that greater control of situational context is essential to continuing investigations.

7. Pace's concern with explaining results like ours is certainly a next important step and hypotheses will help shape empirical work. At this point we feel the most need for elicitation techniques that anticipate and control a wide variety of situational variables. A better understanding of the role of these variables might be one way of approaching the difficult problem of communicative intent which, as Pace and others suggest, is fundamental in interpreting observations such as ours regarding discourse choices.